SOUTHALLS' MATERIA MEDICA.

BARCLAY.

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SOUTHALLS'

ORGANIC MATERIA MEDICA.

BARCLAY.

BUDSC
Hls 6th ed

SOUTHALLS'

ORGANIC MATERIA MEDICA.

BY

JOHN BARCLAY, B.Sc. (LOND.), F.C.S.

A HANDBOOK TREATING OF THE MORE IMPORTANT OF THE ANIMAL AND VEGETABLE DRUGS MADE USE OF IN MEDICINE, INCLUDING THE WHOLE OF THOSE CONTAINED IN THE BRITISH PHARMACOPŒIA;

DESIGNED FOR THE USE OF
TEACHERS, PHARMACEUTICAL AND MEDICAL STUDENTS,
CHEMISTS, DRUGGISTS AND OTHERS.

SEVENTH EDITION.

REVISED AND ENLARGED BY

ERNEST W. MANN,

PHARMACEUTICAL CHEMIST,

SOMETIME EXTERNAL EXAMINER IN MATERIA MEDICA AND PHARMACY TO THE UNIVERSITY OF BIRMINGHAM.

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PREFACE TO FIFTH AND ENLARGED EDITION.

THE First Edition of "Southall's Materia Medica" was prepared in 1874 by the late William Southall, F.L.S., and thirteen years later, in 1887, a fourth and enlarged edition was published. This latter has been for some time out of print, and the occasion of the preparation of a new edition was regarded as a favourable one for making some very considerable amplifications and alterations.

The once almost universal system of classification, according to Botanical origin, has been abandoned, that of placing together drugs of analogous form and physical character having been adopted in its stead. This method of classification may now be said to have received official sanction in this country, inasmuch as it is made use of in the Calendar of the Pharmaceutical Society. In order, however, to facilitate the comparison of drugs of allied Botanical origin, a list of the more important medicine-yielding plants classified under Natural Orders is given at the commencement of the book.

The number of drugs treated upon has been considerably extended, notably in the direction of those of Transatlantic origin, this course having seemed advisable on account of the increasing favour with which those remedies have been received in this country during the last few years.

The chemical notes have been somewhat amplified, and an attempt has been made to bring them up to date; while the use of small type in the form of notes dealing with matters of minor importance, such as substitutions, adulterations, allied drugs, etc., has been adopted, it being intended that the student may thus, to some extent, be guided as to the relative value of the different items of information supplied.

The introduction of a few words concerning the uses to which each drug is applied is a feature new to this edition; but there is here no intention of teaching the student either Pharmacology or Therapeutics, the aim being merely to give him just such information as a person engaged in the handling of drugs might with advantage possess.

In treating of those substances which are included in the British Pharmacopœia, the official preparations of these are enumerated, mention also being made of their strengths, and in case of tinctures, etc., of the menstrua used in preparing them, whilst such non-official preparations as are considered sufficiently noteworthy are also referred to. In the articles on foreign official drugs reference is usually made to the Pharmacopœias

in which they are included, the more important preparations of these and of non-official drugs also at the same time receiving mention.

An attempt has been made to give, as an introduction to each group of drugs, an outline of the physical and chemical characters common to that group, it being thought that the student will thereby be aided in his study of the individual members. To further assist him in the correct understanding of the technical terms of description made use of, a glossary of these has been compiled and added at the end of the book. Matter relating to the British Official Materia Medica is printed in large type, in order to make a distinction between these and the less important substances which may or may not be official in other countries.

The author of the present edition wishes it to be clearly understood that the work in no sense pretends to be anything other than a compilation, and to the student whose means of access to larger works of reference are limited, a book of this kind, compiled as it is from many and various sources, should be of considerable value. Some of the information made use of, particularly that dealing with recent work, has been gleaned from original papers. but the bulk of the matter is derived from the admirable text-books and other works mentioned below. Instead of scattering references to sources of information made use of throughout the text, a course which would have involved considerable difficulty, and which for a work of this kind seemed inadvisable, it appeared better to acknowledge in this place the sources to which the Editor of the book is chiefly indebted.

In the case of those substances included in the British, United States, and Indian Pharmacopœias, the official descriptions found therein are quoted almost *verbatim;* while for information concerning the characters of many of the others, the author is indebted to those most admirable compilations, the National and United States Dispensatories. The same two works have also furnished material for many of the chemical notes provided, and it is not too much to say that but for their existence a considerable portion of this work could never have appeared.

Similarly, the *Pharmacographia* (Flückiger and Hanbury) and the Text Books of Pereira (*Elements of Materia Medica and Therapeutics*) and Maisch (*Manual of Organic Materia Medica*) have been of great assistance. The Editor is also indebted for much valuable information to *Squire's Companion to the British Pharmacopœia* (Sixteenth Edition), and *Martindale and Westcott's Extra Pharmacopœia* (Eighth Edition). For the purely chemical part of the work much help has been derived from the following:—*Attfield's Chemistry*, *Richter's Organic Chemistry*, *Thorpe's Dictionary of Applied Chemistry*, and *Allen's Commercial Organic Analysis*, while the papers of J. C. Umney (*Essential Oils in their Relation to the British Pharmacopœia and Trade*), and the Pamphlet of Helbing and Passmore dealing with the

same subject have been of great service in supplying information for writing the article on Volatile Oils.

The student who is desirous of making a more detailed study of the subject cannot do better than turn to the above-mentioned works and papers.

Of the many imperfections of the work the author is sufficiently aware; but the favour with which the preceding editions of the book have been received, as well as the numerous enquiries made for it during the time in which it has been out of print, give fair warranty for the belief that it has hitherto met a demand which should not be permitted to go unsupplied. J. B.

BIRMINGHAM,
March, 1896.

PREFACE TO SEVENTH EDITION.

THE Sixth Edition of this work has been for some time out of print and in preparing the seventh, the opportunity has been taken to thoroughly revise the whole, and more especially to bring up to date those parts which continued advances in chemistry and pharmacognosy have rendered more or less incomplete.

The general scheme of the book remains unchanged, experience having shown the system of classification adopted to be the most suitable for the student's requirements; and while every effort has been made to exclude unimportant matter, some increase in the size of the work has been found unavoidable.

The monographs on chemistry have in most instances been amplified and the more important preparations of the British Pharmaceutical Codex are included. The index, too, has been carefully re-written, and leading references are distinguished by different type; this should prove of increased value for reference purposes.

No attempt has been made to illustrate the drugs treated upon, the Editor holding the opinion that the study of Materia Medica is essentially a practical science and the student can only hope to obtain a thorough knowledge of its objects by actual personal examination of the drugs concerned, using the text-book as a guide, and verifying for himself the peculiarities characteristic of each.

In conclusion, the Editor wishes to acknowledge the kindness of Dr. T. Slater Price, of the Birmingham Municipal Technical School, in reading the proofs of the Appendix on Alkaloids.

BIRMINGHAM, E. W. M.
February, 1909.

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LIST OF BOOKS REFERRED TO, CONTAINING PLATES OF OFFICIAL PLANTS.

BENTLEY AND TRIMEN, *Medicinal Plants*. 4 vols. large 8vo. London, 1875—1880.

BERG UND SCHMIDT, *Darstellung und Beschreibung sämmtlicher in der Pharmacopæa Borussica aufgeführten offizinellen Gewächse*. 4 vols. 4to. Leipzig, 1858—1863.

Botanical Magazine. 8vo. London, 1787—1898.

BRANDT UND RATZEBURG, *Medicinische Zoologie*. 2 vols. 63 Pl. Berlin, 1829—1833.

COLLINS, J., *Report on Caoutchouc*. London, 1872.

HOOKER, *Icones Plantarum*. 27 vols. 8vo. London, 1837—1898.

Kew Bulletin of Miscellaneous Information. 1887,

LAMBERT, *A Description of the genus Pinus*. 2 vols. folio. London, 1803, 1828.

MARTIUS, C. F. P. VON, *Flora Brasiliensis*. 15 vols. folio. Leipzig, 1840—1898.

MOGGRIDGE, J. T., *Contributions to the Flora of Mentone*. Large 8vo. London, 1874.

MUELLER, F. VON, *Eucalyptographia*. Royal 4to. Melbourne, 1879.

NEES VON ESENBECK, T. F. L., *Plantæ Medicinales*. 3 vols. plates; 1 vol. text; folio. Düsseldorf, 1828—1833.

Pharmaceutical Journal. Series I.—IV. London, 1842—1898.

REDOUTÉ, P. J., *Les Roses*. 3 vols. folio. Paris, 1817—1824.

RUIZ AND PAVON, *Flora Peruviana et Chilensis*. 3 vols. folio. Madrid, 1798—1802.

SARGENT, C.S., *The Silva of North America*. 10 vols. folio. Boston and New York, 1891—1896.

STEPHENSON AND CHURCHILL, *Medical Botany*. 4 vols. 8vo. London, 1831.

Transactions of the Linnean Society of London. Botany. 4to. London, 1791—1898.

ABBREVIATIONS.

N.O.	..	Natural Order.
Syn.	..	Synonym.
B.P.	..	British Pharmacopœia.
U.S.	..	United States.
U.S.P.	..	United States Pharmacopœia.
P.B.	..	Pharmacopœia Britannica.
P.G.	..	Pharmacopœia Germanica.
P.L.	..	Pharmacopœia Londinensis.
P.I.	..	Pharmacopœia Indica.
B.P.C.	..	British Pharmaceutical Codex.
N.F.	..	National Formulary.
S.G.	..	Specific Gravity.
F.	..	Fahrenheit.
C.	..	Centigrade.
M.P.	..	Melting Point.
Hab.	..	Habitat.

CLASSIFICATION OF

BOTANICAL MATERIA MEDICA

ACCORDING TO

NATURAL ORDERS.

(SYSTEM OF BENTHAM AND HOOKER).

British Flora are marked with an asterisk (*); those contained in the British Pharmacopœia are underlined.

Sub-Kingdom I.—PHANEROGAMIA.

Class I.—ANGIOSPERMÆ.

Sub-Class I.—DICOTYLEDONES.

Division I.—POLYPETALÆ.

Sub-Division I.—THALAMIFLORÆ.

Natural Order.—RANUNCULACEÆ.

Delphinium Staphisagria.
Nigella sativa.
Nigella damascena.
*Aconitum Napellus.
Aconitum heterophyllum.
Aconitum ferox.
Aconitum Fischeri.
Cimicifuga racemosa.
Helleborus niger.
Hydrastis canadensis.
Coptis Teeta.
*Anemone Pulsatilla.
Anemone hepatica.
Adonis vernalis.

MAGNOLIACEÆ.

Magnolia, *spec. var.*
Illicium anisatum.
Drymis Winteri.

MENISPERMACEÆ.

Menispermum canadense.
Jateorrhiza Calumba.
Tinospora cordifolia.
Chondrodendron tomentosum.
Anamirta paniculata.

BERBERIDACEÆ.
*Berberis vulgaris.
Caulophyllum thalictroides.
Podophyllum peltatum.
Podophyllum emodi.

PAPAVERACEÆ.
Papaver somniferum.
*Papaver Rhœas.
Sanguinaria canadensis.
*Chelidonium majus.
Corydalis formosa.

CRUCIFERÆ.
*Brassica (Sinapis) alba.
*Brassica (Sinapis) nigra.
Brassica sinapoides.
Brassica juncea.
*Brassica campestris.
*Cochlearia Armoracia.

CISTACEÆ.
Helianthemum canadense.
Helianthemum corymbosum.
Cistus, *spec. var.*

VIOLACEÆ.
*Viola tricolor.
*Viola odorata.

CANELLACEÆ.
Canella alba.
Cinnamodendron corticosum.

BIXACEÆ.
Bixa Orellana.
Taraktagenos Kurzii.

POLYGALACEÆ.
Polygala Senega.
Krameria triandra.
Krameria argentea.

CARYOPHYLLACEÆ.
Saponaria officinalis.

HYPERICINACEÆ.
*Hypericum perforatum.

GUTTIFERÆ.
Garcinia Hanburii.

TERNSTRŒMIACEÆ (CAMELLIACEÆ).
Camellia Thea.

DIPTEROCARPACEÆ.
Dipterocarpus turbinatus.

MALVACEÆ.
*Althæa officinalis.
Hibiscus abelmoschus.
Hibiscus esculentus.
Gossypium barbadense.
Gossypium herbaceum.

STERCULIACEÆ.
Cola vera.
Cola acuminata.
Theobroma Cacao.

CAPPARIDACEÆ.
Capparis Spinosa.

Sub-Division II.—**DISCIFLORÆ.**

Natural Order.—LINACEÆ.
*Linum usitatissimum.
*Linum catharticum.
Erythroxylon Coca.

ZYGOPHYLLACEÆ.
Guaiacum sanctum.
Guaiacum officinale.

GERANIACEÆ.
Geranium maculatum.

RUTACEÆ.
Citrus Aurantium *var.* bigaradia.
Citrus Bergamia.
Citrus limetta.
Citrus medica *var.* β Limonum.
*Ruta graveolens.
Cusparia febrifuga.
Ægle Marmelos.
Xanthoxylum americanum.
Fagara Clava-Herculis.
Toddalea aculeata.
Barosma betulina.
Barosma crenulata.
Barosma serratifolia.
Pilocarpus Jaborandi.
Pilocarpus, *spec. var.*

SIMARUBACEÆ.
Picræna (Quassia) excelsa.
Simaruba amara.

BURSERACEÆ.
Balsamodendron Myrrha.
Balsamodendron Mukul.
Balsamodendron africanum.
Boswellia Carterii.
Canarium commune.

MELIACEÆ (CEDRELACEÆ).
Soymida febrifuga.
Azadirachta indica.

AQUIFOLIACEÆ (ILICINEÆ).
Ilex paraguayensis.
Prinos verticillatus.
*Ilex aquifolium.

CELASTRACEÆ.
Euonymus atropurpureus.

RHAMNACEÆ.
Rhamnus purshianus.
*Rhamnus catharticus.
*Rhamnus Frangula.
Ceanothus americanus.

AMPELIDACEÆ.
Vitis vinifera.

SAPINDACEÆ.
Paullinia Cupana.
Æsculus hippocastanum.

ANACARDIACEÆ.
Anacardium occidentale.
Pistacia lentiscus.
Pistacia Terebinthus.
Rhus radicans.
Rhus glabra.
Rhus toxicodendron.

CORIARACEÆ.
Coriaria myrtifolia.

Sub-Division III.—**CALYCIFLORÆ.**

Natural Order—LEGUMINOSÆ.
Dipteryx odorata.
Dipteryx oppositifolia.
Physostigma venenosum.
Physostigma cylindrospermum.
Trigonella Fœnum-græcum.
Abrus precatorius.
Arachis hypogœa.
Guilandina Bonduc.
Guilandina Bonducella.
Glycyrrhiza glabra.
Baptisia tinctoria.
Hæmatoxylon campechianum.
Pterocarpus Santalinus.
Cassia fistula.
Cassia acutifolia.
Cassia angustifolia.
*Cytisus Scoparius.
*Melilotus officinalis.
Tamarindus indica.
Indigofera tinctoria.
Coronilla scorpioides.
Erythrophlœum guineense.
Piscidia erythrina.
Mucuna pruriens.
Andira Araroba.
Pterocarpus Marsupium.
Acacia Catechu.
Acacia Senegal.
Astragalus gummifer.
Copaifera Langsdorffii.
Myroxylon toluifera.
Myroxylon Pereiræ.
Lathyrus sativus.

ROSACEÆ.
Prunus Amygdalus.
Prunus Laurocerasus.
*Prunus domestica.
Prunus serotina.
Rosa centifolia.
Rosa gallica.
*Rosa canina.
Rosa damascena.
Pyrus Cydonia.
*Potentilla Tormentilla.
*Geum urbanum.
Hagenia abyssinica.
(Brayera anthelmintica).
*Rubus Idæus.
Rubus. *spec var.*
Quillaja Saponaria.

SAXIFRAGACEÆ.
Heuchera americana.
Hydrangea arborescens.

HAMAMELACEÆ.
Hamamelis virginica
Liquidambar orientalis

CACTACEÆ.
Anhalonium lewinii.
Cactus (cereus) grandiflorus.

COMBRETACEÆ.
Terminalia, *spec. var.*
Combretum sundaicum.

MYRTACEÆ.
Eucalyptus rostrata.
Eucalyptus globulus.
Eucalyptus resinifera
Eucalyptus amygdalina.
Eucalyptus. *spec. var.*
Myrcia acris.
Myrtus Chekan.
Eugenia caryophyllata.
Eugenia jambolana.
Pimenta officinalis
Pimenta (myrtus) acris.
Melaleuca leucadendron.

GRANATACEÆ (LYTHRARIACEÆ).
Punica Granatum.

ONAGRARIACEÆ.
*Epilobium angustifolium.

TURNERACEÆ.
Turnera diffusa.

CUCURBITACEÆ.
Cucurbita maxima.
*Bryonia alba.
*Bryonia dioica.
Citrullus Colocynthis.
Luffa egyptiaca.
Ecballium Elaterium.

UMBELLIFERÆ.
Ferula Sumbul.
Ferula galbaniflua.
(Ferula rubricaulis).
Ferula fœtida.
*Angelica Archangelica.
*Petroselinum sativum.
*Peucedanum Ostruthium.
*Conium maculatum.
Hydrocotyle asiatica.
*Apium graveolens.
*Carum Carvi.
Carum copticum.
*Coriandrum sativum.
Cuminum Cyminum.
Pimpinella Anisum.
*Fœniculum capillaceum.
Peucedanum graveolens.
*Œnanthe Phellandrium.
*Daucus Carota.
Dorema Ammoniacum.
Opoponax Chironium.

CORNACEÆ
Cornus florida.

ARALIACEÆ.
Aralia racemosa.

Division II.—**GAMOPETALÆ.**

Sub-Division I.—**INFERÆ.**

Natural Order—CAPRIFOLIACEÆ.
*Sambucus nigra.
Viburnum prunifolium.
*Viburnum opulus.

RUBIACEÆ.
Coffea arabica.
Coffea liberica.
Cephaëlis Ipecacuanha.
*Rubia tinctorum.
Chiococca racemosa.
*Galium Aparine.
Randia dumetorum.
Cinchona succirubra.
Cinchona, *spec. var.*
Remijia, *spec. var.*
Uncaria Gambier.
Mitchella repens.

VALERIANACEÆ.
*Valeriana officinalis.

COMPOSITÆ.
*Tussilago Farfara.
Grindelia robusta.
Grindelia squarrosa.
*Taraxacum officinale.
*Cichorium Intybus.
*Inula Helenium.

COMPOSITÆ—*continued.*
Anacyclus Pyrethrum.
*Lappa officinalis.
*Artemisia vulgaris.
*Artemisia Absinthium.
*Artemisia maritima.
Arnica montana.
*Calendula officinalis.
*Matricaria Chamomilla.
*Anthemis nobilis.
*Anthemis Cotula.
Pyrethrum cinerariæfolium.
Carthamus tinctorius.
Eupatorium perfoliatum.
*Erigeron canadense.
*Achillea millefolium.
*Tanacetum vulgare.
Cnicus benedictus.
*Lactuca virosa.
*Silybum Marianum.
Vernonia nigritiana.

CAMPANULACEÆ.
Lobelia inflata.

Sub-Division II.—**HETEROMERÆ.**
Natural Order—ERICACEÆ.
*Arctostaphylos Uva-ursi.
Chimaphilla umbellata.
Gaultheria procumbens.
*Ledum palustre.

PLUMBAGINACEÆ.
*Statice Limonium.

MYRCINACEÆ.
Embelia Ribes.

SAPOTACEÆ.
Palaquium, *spec*
Chrysophyllum glycyphlœum.

EBENACEÆ.
Diospyros embryopteris.

STYRACEÆ.
Styrax Benzoin.

Sub-Division III.—**BICARPELLATÆ.**
Natural Order—OLEACEÆ.
Olea europœa.
Fraxinus Ornus.

APOCYNACEÆ.
Apocynum Cannabinum.
Nerium Oleander.
Alstonia constricta.
Alstonia scholaris.
Aspidosperma Quebracho.
Strophanthus kombé.
Strophanthus gratus.
Strophanthus Courmontii.
Strophanthus Nicholsoni.
*Vinca major.
*Vinca minor.

ASCLEPIADACEÆ.
Hemidesmus Indicus.
Asclepias tuberosa.
Tylophora asthmatica.
Gonolobus Condurango.
Calotropis gigantea.

LOGANIACEÆ.
Strychnos Nux Vomica.
Strychnos Ignatia.
Strychnos Castelnœana.
Gelsemium nitidum.
Spigelia marilandica.

GENTIANACEÆ.
Gentiana lutea.
Frasera Walteri.
*Menyanthes trifoliata.
Ophelia Chirata.
*Erythræa Centaurium.

HYDROPHYLLACEÆ.
Eriodictyon glutinosum.

BORAGINACEÆ.
Anchusa tinctoria.
*Symphytum officinale.

CONVOLVULACEÆ.
Convolvulus Scammonia.
Ipomœa purga.

SOLANACEÆ.
*Datura Stramonium.
*Hyoscyamus niger.
*Atropa Belladonna.
Nicotiana Tabacum.
Duboisia myoporoides.
*Solanum Dulcamara.
Capsicum minimum.
Capsicum annuum.
Fabiana imbricata.

SCROPHULARIACEÆ.
*Digitalis purpurea.
Leptandra virginica.

PEDALIACEÆ.
Sesamum indicum.

LABIATEÆ.
Collinsonia canadensis.
Rosmarinus officinalis.
Thymus vulgaris.
Salvia officinalis.
*Lavandula vera.
*Marrubium vulgare.
*Mentha piperita.
*Mentha viridis.
*Mentha Pulegium.
*Mentha arvensis.
Hyssopus officinalis.
*Origanum vulgare.

LABIATEÆ—*continued.*
*Melissa officinalis.
Hedeoma pulegioides.
Monarda punctata.
Scutellaria laterifolia.
Pogostemon Patchouli.

Division III.—**MONOCHLAMYDEÆ. (INCOMPLETÆ).**

CHENOPODIACEÆ.
*Chenopodium ambrosioides.

PHYTOLACCACEÆ.
Phytolacca decandra.

POLYGONACEÆ.
Rheum, *spec. var.*
*Polygonum Bistorta.
*Rumex acetosa.
*Rumex crispus.

ARISTOLOCHIACEÆ.
Aristolochia Serpentaria.
Aristolochia reticulata.
Asarum canadense.

PIPERACEÆ.
Piper Methysticum.
Piper angustifolium.
Piper Cubeba.
Piper nigrum.
Piper officinarum.
Chavica Roxburghii.

MYRISTICACEÆ.
Myristica fragrans.
Myristica fatua

MONIMIACEÆ.
Pneumus Boldo.

LAURACEÆ (LAURINEÆ).
Sassafras officinale.
Laurus nobilis.
Nectandra Rodiæi.
Cinnamomum Cassia.
Cinnamomum Camphora.
Cinnamomum zeylanicum.
Coto.

THYMELACEÆ.
*Daphne Mezereum.
Daphne Gnidium.
*Daphne Laureola.

SANTALACEÆ.
Santalum album.

EUPHORBIACEÆ.
Croton Tiglium.
Ricinus communis.
Curcas purgans.
Euphorbia Ipecacuanha.
Stillingia sylvatica.
Euphorbia pilulifera.

EUPHORBIACEÆ—*continued.*
Euphorbia resinifera.
Croton Eleuteria.
Mallotus phillipinensis.
Hevea brasiliensis.
Manihot utilissima.
Manihot Apii.

URTICACEÆ (ULMACEÆ, MORACEÆ).
Cannabis sativa.
*Humulus Lupulus.
Morus nigra.
Ulmus fulva.
*Ulmus campestris.
Parietaria officinalis.
Ficus Carica.
Dorstenia contrajerva.

JUGLANDACEÆ.
Juglans cinerea.
Juglans regia.

MYRICACEÆ.
Myrica cerifera.

CUPULIFERÆ.
Castanea dentata.
*Quercus robur.
Quercus lusitanica.

SALICACEÆ.
*Salix, *spec. var.*
*Populus, *spec. var.*

Sub-Class II.—MONOCOTYLEDONES.

Division I.—MICROSPERMÆ.

ORCHIDACEÆ.
Orchis, *spec. var.*
Cypripedium, *spec. var.*
Vanilla planifolia.

Division II.—EPIGYNÆ.

ZINGIBERACEÆ (SCITAMINEÆ).
Amomum Melegueta.
Zingiber officinale.
Curcuma longa.
Alpinia officinarum.
Alpinia Galanga.
Elettaria Cardamomum.

HÆMADORACEÆ.
Aletris farinosa.

IRIDACEÆ
Iris Florentina.
Iris versicolor.
*Crocus sativus.

Division III.—CORONARIÆ.

LILIACEÆ (SMILACEÆ).
Colchicum autumnale.
Schœnocaulon officinalis.
Smilax officinalis.

LILIACEÆ (SMILACEÆ)—*continued.*
Urginea Scilla.
Veratrum viride.
Veratrum album.
Allium sativum.
*Convallaria majalis.
Aloe Perryi.
Aloe vera.
Aloe spicata.
Smilax China.

Division IV.—**CALICYNEÆ.**

JUNCACEÆ.
Xanthorrhœa hastilis.
Xanthorrhœa arborea.

PALMACEÆ (PALMEÆ).
Areca Catechu.
Calamus draco.
Elais guineensis.
Cocos nucifera.
Metroxylon Sagu.
Arenga saccharifera.
Serenoa serrulata.

Division V.—**NIDIFLORÆ.**

AROIDACEÆ.
*Arum maculatum.
*Acorus Calamus.

Division VI.—**APOCARPEÆ.**

Division VII.—**GLUMACEÆ.**

GRAMINACEÆ.
*Agropyrum repens.
Zea Mays.
Hordeum distichon.
*Phalaris canariensis.
Cymbopogon nardus.
Cymbopogon citratum.
Triticum sativum.
Oryza sativa.

Class II.—GYMNOSPERMÆ.

CONIFERÆ.
Juniperus Sabina.
Thuja occidentalis.
*Juniperus communis.
Juniperus Oxycedrus.
Pinus Larix.
Pinus picea.
Pinus australis.
Pinus tæda.
Pinus balsamea.
Pinus sylvestris.
Pinus Pumilio.
Pinus Pinaster.
Pinus, *spec. var.*
Pinus Dammara.
Callitris quadrivalvis.
Dammara australis.
Pinites succinifer.

Sub-Kingdom II.—CRYPTOGAMIA.

Class I.—THALLOPHYTA.

Sub-Class I.—ALGÆ.

Division I.—PHÆOPHYCEÆ.

Sub-Division I.—PHÆOSPOREÆ.

Laminaria digitata.

Sub-Division II.—FUCACEÆ.

Fucus vesiculosus.

Division II.—RHODOPHYCEÆ. (FLORIDEÆ).

Chondrus crispus.
Chondrus mammilosus.
Gracillaria lichenoides.
Gracillaria confervoides.

Sub-Class II.—FUNGI.

Division I.—USTILAGINEÆ.

Ustilago Maydis.

Division II.—ASCOMYCETES.

Sub-Division I.—SACCHAROMYCETES.

Saccharomyces Cerevisiæ.

Sub-Division II.—PYRENOMYCETES.

Claviceps purpurea.

Sub-Division III.—LICHENES.

Cetraria islandica.
Lecanora, *spec. var.*
Rocella, *spec. var.*

Division III.—BASIDIOMYCETES.

Sub-Division I.—HYMENOMYCETES.

Boletus Laricis.
Boletus igniarius.

Class II.—VASCULAR CRYPTOGAMS.

Sub-Class I.—FILICINEÆ. (FILICES).

Aspidium Filix mas.
Adiantum capillis veneris.

Sub-Class II.—LYCOPODINEÆ.

Division—LYCOPODIACEÆ.

Lycopodium clavatum.

SECTION 1.

ORGANISED DRUGS OF VEGETABLE ORIGIN

Under this head are included all vegetable drugs having definite organised structure, and consisting of some form of cellular tissue.

A. PHANEROGAMOUS.

These consist of organised vegetable drugs derived from, or themselves being, flowering plants.

1. SEEDS.—SEMINA.

General Morphology of the Seed.—The seed is the fertilised ovule, modified by the changes induced as secondary results of fertilisation, it contains the *embryo* or rudimentary plant with its accompanying food material or *albumen*. When the seed has a stalk it is known as the *podosperm*, which corresponds to the *funiculus* of the ovule, the point of attachment in the fruit whether the seed be stalked or sessile being known as the *hilum*. The foramen through which the descending radicle of the embryo passes during germination is known as the *micropyle*, and the proper base of the seed from which, during development, the coats of the ovule originate is known as the *chalaza*. When the micropyle and the hilum (with the chalaza) are situated at the opposite ends of an imaginary straight line, drawn from the base of the seed to its apex, the seed is said to be *orthotropous;* when the ovule, in the course of growth, has curved on itself in such a way as to bring the apex of the seed near the base, but having the micropyle and hilum (with chalaza) still at opposite ends, the seed is said to be *campylotropous*, *e.g.*, seeds of many Cruciferæ, Chenopodiaceæ; but when, as is most commonly the case, the ovule, in course of growth, has become completely inverted on its base, being parallel with the apparent continuation of the funicle, and so bringing the chalaza to the apex of the seed while leaving the hilum at its base, is said to be *anatropous*. The apparent continuation of the funicle from the hilum to

the chalaza is frequently marked by a corded thickening, and is known as the *raphe*. The seed-coats are normally two—an outer *testa* and an inner *tegmen*. The testa not infrequently has appendages useful for dissemination purposes, *e.g.*, the wing of the Pine seed, the cotton of the seed of Gossypium, the awn of Strophanthus, etc.; or, again, it may be covered with short hairs, or its epidermal cell walls may be mucilaginous (cress, flax), thus affording a useful power of adhesion. The raphe may be prominent and easily discernible, or it may be hidden. Certain seeds have appendages of more or less crest-like form, *e.g.*, the *caruncle* of the seed of Ricinus, while an accessory seed covering, more or less complete, is formed during the ripening of certain seeds, and is known as the *aril*. The point from which the growth of the aril normally takes place is the hilum, but in the nutmeg it is formed round the micropylar end; it may be either fleshy (Podophyllum) or membranous (Cardamomum). The albumen or food material may be present in the seed either surrounding the embryo in which case the seed is said to be *albuminous*, or the embryo may, in the course of its development, have absorbed the whole of the food material and so rendered the seed *exalbuminous*; if the nucellar tissue of the ovule has been entirely disorganised after fertilisation, the albumen is known as *endosperm*, if any of this tissue persists in the seed it is described as *perisperm*. The albumen may be *farinaceous* (*e.g.*, cereals); *oily* (*e.g.*, poppy); *fleshy* (*e.g.*, horse-chestnut); *corneous* (*e.g.*, coffee), *bony* (*e.g.*, vegetable ivory); or un-uniform (*e.g.*, nutmeg, where, by the involution of the tegmen, it becomes *ruminated*). The embryo consists of four parts, viz., the *radicle*, the *hypocotyl*, between radicle and plumule, the *cotyledons*, or seed leaves, and the *plumule*, or primary shoot of the future plant. The disposition of the embryo with regard to the albumen is various, it being either straight or variously curved, while the cotyledons may be more or less separated, or folded on one another in many different ways.

General Chemical Characters of Seeds.—Since the seed is the reservoir of reserve food material for the young plant, it usually consists largely of nutritive substance, carbohydrate, protein, or fats, etc. In the cereals and in many leguminous seeds, such as physostigma, we meet with starch and protein, the latter in the form of *gluten* in the cereals, of *legumin* in the Leguminosæ. Fat or fixed oil is also frequently met with, *e.g.*, seeds of castor, flax, nutmeg, etc. The seed commonly contains also some enzyme by means of which, during germination, the food material is rendered soluble and capable of absorption by the young plant. Associated with these and similar inert substances are to be found those active principles to the presence of which the medicinal seeds owe their value; these are of the most varied kind, and may be regarded as excretory products, since they appear to have no useful place in the plant economy. The amount of mineral matter present in seeds varies from 1 or 1½ per cent.

(Nux Vomica) to as much as 8 or 9 per cent. (Stavesacre), and contains usually potash, soda, magnesia, lime, phosphorus, sulphur, silica, and iron in varying proportions.

STAPHISAGRIÆ SEMINA.—Stavesacre Seeds.—The dried ripe seeds of Delphinium Staphisagria, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 4].

N.O.—Ranunculaceæ.

Syn.—Semina Staphidis agriæ seu pedicularis.

Habitat.—Southern Europe and Asia Minor.

B.P. Characters.—Irregularly triangular or obscurely quadrangular, arched, blackish-brown when fresh, but becoming dull greyish-brown by keeping. Testa wrinkled and deeply pitted; interior soft, whitish, oily. No marked odour; taste nauseous, bitter and acrid.

The seed consists entirely of endosperm with a very minute embryo.

Chemistry.—The yellowish endosperm contains about 30 per cent. of a fixed oil. The seeds contain about 1 per cent. of total alkaloids, the greater part of which is dissolved in the fixed oil when extracted. *Delphinine* ($C_{31}H_{49}NO_7$), *Delphisine*, *Delphinoidine*, *Staphisagrine* have been described, of which *Delphinine* is the most important and possesses a powerful action similar to that of aconitine. *Staphisagrine* is a mixture, while *Delphisine* has been termed a decomposition product of *Delphinine*.

Uses, etc.—Chiefly in the form of ointment for the destruction of pediculi.

B.P. Preparation.

Unguentum Staphisagriæ, 1 in 5, nearly.

B.P.C. Preparation.—Lotio Staphisagriæ.

Note.—Delphinium Consolida—Larkspur—(*N.O.*, Ranunculaceæ, *Syn.*, Knightspur, *Habitat*, Central Europe and cultivated) is the source of *flores*, *herbæ*, and *semen consolidæ*. Delphinium ajacis, Delphinium exaltatum, Delphinium azureum are nearly allied to the above.

NIGELLA.—Fennel Flower.—The seeds of Nigella sativa *Linn.* and of N. damascena *Linn.*

N.O.—Ranunculaceæ.

Syn.—Faux cumin.

Habitat.—Southern Europe (and cultivated).

Characters.—About one-twelfth of an inch in length, triangular ovate, rough externally, dull black internally, white, and containing a small straight embryo. The seeds of N. damascena have a strawberry-like odour, and a deeply-wrinkled testa.

Chemistry.—Fixed oil (33 per cent.) volatile oil and a glucoside *melanthin*.

Damascenine is a volatile alkaloid existing in N. damascena.

SINAPIS ALBÆ SEMINA.—White Mustard Seed.

—The dried ripe seeds of Brassica alba, *Boiss* [*Bentl. and Trim. Med. Pl.* vol. i. plate 23.]

N.O.—Cruciferæ.

Habitat.—Britain.

B.P. Characters.—The seeds are about one-twelfth of an inch (two millimetres) in diameter and one-tenth of a grain (six and a half milligrammes) in weight, spheroidal, of a pale yellow colour, with a very finely pitted and reticulated testa. Externally they are hard, internally yellow and oily. Inodorous when entire or powdered; almost inodorous when triturated with *water*. In taste less pungent than Black Mustard Seeds.

The seeds, which are really yellow, are contained in hispid spreading siliquas, which are characterised by being beaked (compare black mustard seed).

Chemistry.—The seeds contain a fixed oil (20 to 25 per cent.), the glucoside *sinalbin* and the enzyme *myrosin*. Sinalbin and the ferment myrosin, in the presence of water, yield *isothiocyanate of acrinyl*, an acrid but non-volatile body, together with dextrose and *acid sinapine sulphate* $C_{30}H_{44}N_2S_2O_{16}$=

Sinalbin.

$$C_7H_7ONCS + C_{16}H_{24}NO_5HSO_4 + C_6H_{12}O_6$$

Acrinyl Isothiocyanate. — Acid Sinapine Sulphate. — Dextrose.

There is no starch present in mustard. An infusion of the seeds causes a deep red colour with a solution of ferric chloride.

Uses, etc.—Chiefly for powdering and mixing with black mustard seeds to form mustard (sinapis). White mustard contains an excess of the ferment myrosin, and is therefore mixed with black mustard which is usually deficient in this respect in order to secure a maximum amount of pungency. The powder is used for preparing mustard poultice (cataplasma sinapis). It is not infrequently adulterated with farinaceous substances coloured by turmeric.

B.P. Preparations.

*Sinapis.

**Used in preparing* Charta Sinapis.

B.P.C. Preparations.—Balneum Sinapis, Cataplasma Sinapis.

SINAPIS NIGRÆ SEMINA.—Black Mustard Seed.

—The dried ripe seeds of Brassica nigra, *Koch* [*Bentl. and Trim. Med. Pl.* vol i. plate 22]. (B. sinapoides *Roth*).

N.O.—Cruciferæ.

Habitat.—Britain.

B.P. Characters.—The seeds are about one twenty-fifth of an inch (one millimetre) in diameter and one-fiftieth of a grain (one and a third milligramme) in weight; spherical or slightly ovoid in form. Colour dark reddish-brown or greyish-brown. Testa hard and minutely pitted; interior yellowish-green and oily. When entire or when powdered they are inodorous, but when triturated with *water* they yield a strong pungent odour. Taste somewhat bitter at first, followed immediately by extreme pungency.

The seeds are contained in smooth adpressed siliquas, and are much smaller than those of the white variety. Their pungency is also more marked. Colchicum seeds are larger and much harder.

Chemistry.—Fixed oil (30 to 35 per cent.), the glucoside, *sinigrin (myronate of potassium)* and the enzyme *myrosin*. The pungent odour on trituration with water is due to the interaction of the two last named bodies which are contained in separate cells, and the consequent development of the volatile oil of mustard, known as *isothiocyanate of allyl*. The reaction is that represented by the following equation—

$$C_{10}H_{18}NKS_2O_{10} = C_3H_5CSN + C_6H_{12}O_6 + KHSO_4$$

Sinigrin. Allyl isothiocyanate. Dextrose. Potassium Acid Sulphate.

Ferric chloride solution communicates to an infusion of black mustard seeds an orange tint.

Uses, etc.—For the production of powdered mustard (*see* Sinapis albæ semina) and of the volatile oil.

B.P. Preparations.

*Sinapis.

†Oleum Sinapis volatile.

**Used in preparing* Charta Sinapis.

†*Contained in* Linimentum Sinapis - - 1 in 22½.

B.P.C. Preparations.—Balneum Sinapis, Cataplasma Sinapis.

Note.—Oleum Sinapis Expressum.—(Expressed oil of mustard) is obtained from the seeds of black and white mustard by expression. It is a reddish or brownish-yellow, non-drying, mild tasting, not readily becoming rancid oil, solidifying when cooled to 16° C. It has S.G. 0·916 to 0·920 and consist of the glycerides of *oleic*, *stearic*, *erucic* (*brassic*), *arachidic* and *rapic* acids, and is used for purposes similar to those to which olive and rape oils are applied.

"Mustard Leaves" consist of the crushed seeds deprived of fixed oil (but retaining the pungency producing substances) made to adhere to paper.

BRASSICA JUNCEA.—Indian Mustard.

N.O.—Cruciferæ.

Syn.—Rae, Sarepta.

Habitat.—India (cultivated in Russia).

The seeds of this plant yield Russian or Indian mustard. Their chemical properties are said to be identical with those of black mustard seed.

BRASSICA CAMPESTRIS.—Wild Rape.

N.O.—Cruciferæ.

Syn.—Field cabbage.

Habitat.—Various.

Certain cultivated varieties of this species yield the seeds from which *rape* and *colza oils* are obtained.

GYNOCARDIÆ SEMINA.—Chaulmoogra Seeds.—

The seeds of Taraktagenos Kurzii, *King*.

N.O.—Bixineæ.

Habitat.—Burmah.

Characters.—Ovoid in form, but somewhat irregular, being more or less angular. About one to one and a quarter inches in length, and half an inch in breadth. The testa is brittle, smooth, and grey; nucleus oily and dark brown.

Chemistry.—Fatty oil (obtained by expression), protein, etc., starch is not present. The oil, when pure, is pale-yellow in colour and semi-solid at ordinary temperatures.

Note.—The seeds were formerly erroneously attributed to Gynocardia odorata. The fatty oil which is official in the Indian and Colonial Addendum to the British Pharmacopœia contains *chaulmoogric acid*. It has been used externally and internally in the treatment of leprosy, syphilis, etc.

ABELMOSCHI SEMINA.—Musk Seed.—

The seeds of Hibiscus Abelmoschus *Linn.* (Abelmoschus moschatus).

N.O.—Malvaceæ.

Syn.—Ambretta.

Habitat.—India and Egypt.

Characters.—Flattish, reniform, one-eighth of an inch long, greyish-brown, concentrically striate, internally whitish and oily.

Uses, etc.—In perfumery as a substitute for musk; by the Arabs for flavouring coffee.

Note.—The fruit of Hibiscus (Abelmoschus) esculentus is cultivated in various parts of the world under the name of *gombo*, for the sake of its fruit, which contains much mucilage and which is used for thickening soup.

STERCULIÆ SEMINA.—Kola Nuts.—

The seeds of Cola vera, *Schum.*, C. acuminata, *Schott.*, and other species.

N.O.—Sterculiaceæ.

Syn.—Guru-nuts.

Habitat.—Tropical Western Africa.

Characters.—The kernels are about the size of horse chestnuts; more or less globular, of a fleshy consistence (unless dry); externally of a reddish violet colour, and internally of a dark violet tint when freshly cut. Taste slightly bitter, astringent and somewhat aromatic. Weight from 75 grains to 1 ounce.

Chemistry.—*Caffeine* (1½ to 3 per cent.), glucose, *kola-red*, *theobromine* (traces), starch, nitrogenous matters, cellulose. The three first-named constituents are said to be products of the decomposition of a glucoside (*kolanin*) present in the fresh seeds.

Uses, etc.—As a caffeinic tonic.

B.P.C. Preparations.—Extractum Kolæ liquidum, Tinctura Kolæ, Elixir Kolæ, Vinum Kolæ.

Note.—Garcinia Kola (*Male Kola* or *Kola bitter*) yields fruits easily distinguishable from true Kola seeds by their trigonal section and easily removable testa covered with numerous depressions. The seeds of Heritiera littoralis, occasionally found mixed with Kola Nuts, are flattened, orbicular, and have but one cotyledon double the size of the other. The seed of neither of these contains caffeine.

THEOBROMATIS SEMINA.—Cacao Seeds.—The seeds of Theobroma Cacao, *Linn.*

N.O.—Sterculiaceæ.

Syn.—Nux Cacao.

Habitat.—Tropical America (and cultivated in Ceylon, Java, etc.)

Characters.—From one-half to three-quarters of an inch long, ovate or oblong, somewhat flattened, and varying in colour according to mode of preparation, from brown-red to brown or greyish-brown. Testa is thin papery, and easily broken; odour slight, but when warmed aromatic; the taste is oily, aromatic, and somewhat bitter.

Chemistry.—Fat (50 per cent.) [*see* Oleum Theobromatis]; starch (14 to 18 per cent.); protein (13 to 18 per cent.); *theobromine* (1·2 to 1·5 per cent.); ash (3·5 per cent.), etc.

Uses, etc.—For preparing a nutrient slightly stimulant, beverage.

Theobromine or dimethylxanthine ($C_7H_8N_4O_2$) is an alkaloid closely allied to caffeine in both action and properties, it forms feeble compounds with alkalies, *e.g.*, sodium-theobromine.

Note.—The fruit is about six inches long, in shape like a vegetable marrow, but having a fluted surface. Each contains forty or fifty seeds, surrounded by a mucilaginous white pulp. After drying in the sun, or by other means, the familiar brown colour is produced. The oil is obtained by pressing the seeds between hot iron plates or rollers. The pressed cake is used for the preparation of cocoa and the many articles sold under various names, such as "cocoatina," "theobromine," "cocoa-essence," and chocolate. Chocolate is made by roasting the seeds, removing the integuments, grinding, triturating with sugar and flavouring agents, such as vanilla, and colouring with annatto. Cocoa is prepared either by grinding up the seeds entire between hot rollers into a paste and then mixing with sugar and starch, when it constitutes "common or rock cocoa," or the roasted seeds are divested of their coats and broken into small fragments forming "coco-nibs." The finer varieties of cocoa have much of the indigestible oil removed.

LINUM.—Linseed.—The dried ripe seeds of Linum usitatissimum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. pl. 39.]

N.O.—Linaceæ.

Syn.—Flax Seed.

Habitat.—Britain, Russia, and other countries.

B.P. Characters.—Small, brown, glossy, nearly flat seeds, varying in length from about one-sixth to one-fourth of an inch (four to six millimetres). They are ovate in outline and somewhat obliquely pointed; the surface is glabrous and minutely pitted. Internally they are yellowish-white and contain a narrow oily endosperm and two large oily cotyledons. They are inodorous, but have a mucilaginous oily taste.

A decoction of linseed when cold is not made blue by solution of iodine.

Chemistry.—Besides the *mucilage* and *fixed oil* (30 to 40 per cent., *see* Oleum Lini), protein, small quantities of wax, resin,

sugar, malates, acetates, and other salts are present. The ash amounts to about 3 per cent.

B.P. Preparations.
Linum Contusum.
Oleum Lini yield (by expression) 20 to 30 per cent.

B.P C. Preparations.—Cataplasma Lini, Infusum Lini, Mucilago Lini.

Uses, etc.—Internally in the form of infusion as a demulcent. Externally mixed with boiling water as a poultice.

Linum Contusum P.B. (crushed linseed) consists of the seeds reduced to coarse powder by crushing. It should be recently prepared and have a bland, not pungent or rancid, odour when mixed with warm water. It should yield not less than 30 per cent. of oil when exhausted by carbon bisulphide, and should not give the characteristic reaction with the tests for starch. When incinerated with free access of air it should leave not more than 5 per cent. of ash.

Note.—The variability of the size of flax seed is dependent upon the part of the world where it is grown. The mucilage (15 per cent.) results from a change in the starch during the ripening process, as is shown by the fact that starch is found only in the unripe seeds. The oil is obtained by expression with little—or better—no heat; it is a type of *drying oil*, this property being due to its transformation into *linoxyn*, a substance insoluble in ether. By boiling the oil with a little oxide of lead or compounds of manganese the drying property is greatly increased, and the so-called *boiled oil* is produced. It is occasionally adulterated with resin oil, other seed oils, and paraffin oils. The oil resides in the albuminous tissue and cotyledons, while the mucilage resides in the integuments of the seeds, there is, therefore, no need to bruise them when this latter constituent only has to be removed.

Oil Cake is the residue after the expression of the oil, and is used for feeding cattle.

Linseed meal was formerly English oil cake ground to powder and contained but little oil. Now the crushed seeds containing all the oil are official.

Linen and *lint* (linteum carptum—scraped linen) are the specially prepared and woven bast or liber tissues of the flax plant; a lint prepared from cotton is now, however, extensively used, and may be distinguished from true lint by means of the microscope.

Carron oil is a mixture of equal parts of linseed oil and limewater.

GUARANA.—Guarana.—A dried paste prepared from the crushed or ground seeds (deprived of their aril) of Paullinia Cupana, *Kunth* (Paullinia sorbilis).

N.O.—Sapindaceæ.

Syns.—Paullinia, Brazilian Cocoa.

Habitat.—South America.

Characters.—Sub-globular, elliptic, or cylindrical cakes, hard dark, reddish-brown, fracture uneven, somewhat glossy, showing fragments of seeds invested with a black testa; odour slight, peculiar, resembling chocolate; taste astringent, bitter. It is partly soluble in water and in alcohol.

Chemistry.—Caffeine (guaranine) 2 to 5 per cent. (the U.S.P. officially requires not less than 3 to 5 per cent.), starch, gum, greenish fat, *paullinitannic acid*, saponin, and volatile oil; ash; 2½ per cent.

Uses, etc.—As a caffeinic stimulant, also in South America as an habitual beverage. *Dose.*—20 to 30 grains (in powder).

B.P.C. Preparations.—Elixir Guaranæ, Tinctura Guaranæ. U.S.P. includes Fluid-extractum Guaranæ.

PHYSOSTIGMATIS SEMINA.—Calabar Bean.

—The ripe seeds of Physostigma venenosum, *Balfour* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 80].

N.O.—Leguminosæ.

Syn.—Ordeal Bean.

Habitat.—Western Africa.

B.P. Characters.—Large reddish-brown or chocolate-brown oblong-reniform seeds, usually about one inch (twenty-five millimetres) long, three-quarters of an inch (eighteen millimetres) broad, and half an inch (twelve millimetres) thick. A broad dark furrow extends nearly the entire length of the curved margin. The testa is hard, thick, and somewhat rough, and encloses two firm white starchy cotyledons between which there is a large cavity. The bean has no characteristic taste and no odour.

Chemistry—The alkaloids, *eserine* or *physostigmine* ($C_{15}H_{21}N_3O_2$) about 0·20 per cent., *eseridine* ($C_{15}H_{23}N_3O_3$) and *eseramine* ($C_{16}H_{25}N_4O_3$) the total alkaloidal content being 0·15 to 0·3 per cent., starch (48 per cent.), protein (23 per cent.), fatty oil, mucilage, sugar, with ash, chiefly phosphate of potassium (3 per cent.). The so-called alkaloid *calabarine* formerly regarded as present has been proved to be non-existent ready formed, if at all. Cholesterin-like bodies, *sitosterin* and *stigmasterin* are contained in the cotyledons.

The U.S.P. fixes a standard of not less than 0·15 per cent. total ether soluble alkaloid.

Physostigmine is obtained from the alcoholic extract of Calabar bean by dissolving the extract in water, adding sodium bicarbonate, shaking the mixture with ether, and evaporating the ethereal liquid. It occurs in colourless or pinkish crystals, slightly soluble in water, but readily soluble in alcohol and in dilute acids.

Dose.—1 to 4 grains (in powder).

Uses, etc.—Powerful sedative; contracts the pupil of the eye.

B.P. Preparations.

Extractum Physostigmatis (contains milk sugar).
Physostigminæ Sulphas.

The *B.P.C.* includes Tinctura Physostigmatis.

Physostigminæ Sulphas B.P. (Eserine Sulphate)—$(C_{15}H_{21}N_3O_2)_2,H_2SO_4,xH_2O$, occurs in yellowish-white minute crystals, becoming red by exposure to air and light, having a bitter taste, highly deliquescent, very soluble in *water*, and soluble in alcohol (90 per cent.). The aqueous solution is neutral to *litmus*, and affords the reactions characteristic of sulphates; when shaken with dilute *solution of potassium hydroxide* it becomes red; and when mixed with *solution of ammonia*, and evaporated to dryness on a water-bath, it leaves a bluish residue, the solution of which in very dilute acids is dichroic, being red by reflected and blue by transmitted light. A minute fragment dissolved in a few drops of *fuming nitric acid* yields a yellow liquid, which on evaporation on

a water-bath darkens in colour, the residue when completely dried being of a green colour. A dilute aqueous solution applied to the eye causes contraction of the pupil. It leaves no ash when burned with free access of air.

Dose—$\frac{1}{60}$ to $\frac{1}{20}$ grain.

B.P. Preparation.

Lamellæ Physostigminæ - - - $\frac{1}{1000}$ grain in each.

Note.—The seeds of PHYSOSTIGMA CYLINDROSPERMA, which are longer, nearly cylindrical, of a reddish-brown colour, and with an extremely large hilum, are said to have been substituted for Calabar beans. The seeds of ENTADA SCANDENS, another reputed adulterant, are circular, one or two inches in diameter, one-third of an inch thick, and possess a very small hilum.

TONCO SEMINA.—Tonquin Seeds.—The seeds of Dipteryx odorata *Willd.* (Coumarouna odorata) and D. oppositifolia *Willd.* (Coumarouna oppositifolia).

N.O.—Leguminosæ.

Habitat.—Guiana and Brazil.

Characters.—From an inch to an inch and a half long; from one-fourth to one-half inch broad; usually somewhat compressed, with dark brown, wrinkled, shining, thin and brittle testa, and a light brown, oily kernel. Odour strong, agreeable, and aromatic; taste bitter and aromatic. The seed is often covered with a crystalline encrustation of Coumarin.

Chemistry.—*Coumarin* ($C_6H_4OCHCHCO$), the anhydride of *coumarinic* acid, 1½ to 3 per cent., fixed oils, mucilage and sugar. Coumarin, which is also found in Melilotus officinalis, is a volatile, crystalline, odorous principle, sparingly soluble in water; it may be obtained from alcoholic tinctures of the beans. Coumarin has been prepared synthetically by the interaction of salicylic aldehyde with acetic anhydride and also by the action of phenol upon malic acid.

Uses, etc.—As flavouring agent, and in perfumery. A fluid extract has been recommended in whooping cough.

FŒNI-GRÆCI SEMINA.—Fœnugreek Seeds.—The seeds of Trigonella Fœnum-græcum *Linn.*

N.O.—Leguminosæ.

Syn.—Fenugreek.

Habitat.—West Asia; cultivated in Egypt, etc.

Characters.—Oblong-cylindrical, somewhat compressed, obliquely truncated at each extremity, $\frac{1}{12}$ to $\frac{1}{8}$ inch in length, brownish-yellow externally, yellow internally and marked with an oblique furrow running half their length; odour peculiar; taste oily, bitterish, and farinaceous.

Chemistry.—Fixed and volatile oil, mucilage, *trigonelline, choline* and proteids. Trigonelline is an alkaloid isomeric with pyridine-betaine.

Uses, etc.—Anciently made use of for poultices and emollient purposes, is now much used for cattle medicines.

ABRI SEMINA.—Prayer Beads.—The seeds of Abrus precatorius *Linn.*, (Indian liquorice).

N.O.—Leguminosæ.

Syn.—Jequiriti seeds.

Habitat.—India.

Characters.—Globular ovate, about one-fifth of an inch long, scarlet red, glossy, with a black spot surrounding the hilum; the testa is hard, and encloses a whitish fleshy embryo. No odour, and a slight bean-like taste.

Chemistry—*Abrin*, *Abric acid*, and fixed oil, etc. The activity of the seeds is due to the presence of abrin, a name applied to a mixture of two protein bodies.

Uses, etc.—Each seed weighs about one carat, and they are, therefore, used in India as a standard of weight. An infusion of the seeds is included in the B.P.C., it has a strongly irritating effect upon the eyes, and has been used both to produce and to allay certain ophthalmic diseases.

ARACHIDIS SEMINA.—Ground Nuts.—The seeds of Arachis hypogœa, *Linn.*

N.O.—Leguminosæ.

Syn.—Earth-nuts, Pea-nuts, Goober-nuts.

Habitat.—India, etc.

Characters.—The seeds have a dry, brittle envelope and a yellowish-white kernel. The fruit ripens under ground.

Chemistry.—Fixed non-drying oil, 45 per cent., containing *hypogœic*, *arachidic*, *oleic* and *lignoceric* acids.

Note.—Oil of Arachis (Katchung Oil) is official in the Indian and Colonial Addendum as a substitute for olive oil, has S.G. 0·918, and solidifies at about 3° C., It is used as a lubricant, an illuminant, and as a substitute for, and adulterant of, more valuable oils. The seeds are imported from India under the name of *pistaches*, and are used in a roasted form as an article of food.

BONDUCELLÆ SEMINA.—Bonduc Seeds.—The seeds of Guilandina (Cæsalpinia) Bonduc, *Linn.*, and Guilandina (Cæsalpinia) Bonducella, *Linn.*

N.O.—Leguminosæ.

Syn.—Nicker Seeds.

Habitat.—Tropical Asia, etc.

Characters.—About the size and shape of marbles, and of a dull grey colour; externally smooth and hard, internally white.

Chemistry.—Fixed oil, resin, and a bitter principle.

Uses, etc.—These seeds are official in the Indian Pharmacopœia. They have tonic bitter properties. *Dose*—10 to 15 grains (in powder).

AMYGDALA AMARA.—Bitter Almond.—The ripe seed of Prunus Amygdalus, *Stokes*, *var.* amara, *Baillon.*

N.O.—Rosaceæ.

Habitat.—Morocco, Sicily, South of France, etc.

B.P. Characters.—Resembles the Sweet Almond in general appearance, but is distinguished by being shorter and proportionately broader, by its bitter taste, and by the characteristic odour of its aqueous emulsion.

Chemistry.—Fixed oil (45 per cent.), *see* Oleum Amygdalæ; sugar and gum (5 to 10 per cent.); protein (24 to 30 per cent.), including *emulsin* or *synaptase*; *amygdalin* $C_{20}H_{27}NO_{11}$ (2·5 per cent.) and in organic salts (5 per cent.) By distillation

with water, before or after the expression of the fixed oil, the seeds of this variety yield *essential oil of almonds*. This is the result of the action of the enzyme emulsin upon the nitrogenous glucoside, amygdalin in the presence of water, hydrocyanic acid being produced at the same time

$$C_{20}H_{27}NO_{11} + 2H_2O = C_6H_5CHO + 2C_6H_{12}O_6 + HCN$$

Amygdalin. Benzaldehyde Dextrose. Hydrocyanic Acid.

This interaction can only take place when the seed is bruised since enzyme and glucoside reside in different parts of the cotyledons. Both amygdalin and emulsin are present in bitter almonds, but the latter only in sweet almonds. The yield of oil is from 1 to 3 per cent. In the crude state it consists of benzoic aldehyde (C_6H_5COH) with from 8 to 15 per cent. of hydrocyanic acid. By distillation over milk of lime and ferrous chloride or sulphate, calcium ferro-cyanide is produced and the oil is freed from its poisonous ingredients and rendered comparatively innocuous.

Note.—Hydrocyanic acid frequently occurs in Essential Oil of Almonds in combination with Benzaldehyde as Phenyl-oxy-aceto-nitrile

$$C_6H_5CHO + HCN = C_6H_5CH(OH)CN$$

Phenyl oxy-aceto-nitrile.

The latter compound being decomposed into its constituents on distillation with an alkali or even with water.

Uses, etc.—Bitter almonds are used for preparing the fixed and volatile oils; they yield from 0·1 to 0·8 per cent. hydrocyanic acid.

B.P. Preparations.

Oleum Amygdalæ, *from which are prepared*
- Linimentum Ammoniæ.
- Oleum Phosphoratum (contains 1 per cent. of Phosphorus.)
- Unguentum Aquæ Rosæ.
- „ Cetacei.

B.P.C. Preparations.—Aqua Amygdalæ Amaræ, Mistura Amygdalæ Amaræ, Spiritus Amygdalæ Amaræ.

Oleum Amygdalæ Essentialis—*Essential Oil of Almonds*—(obtained, see above) is a colourless or yellowish thin liquid of a peculiar aromatic odour, a bitter and burning taste, and a neutral reaction. S.G. 1·060 to 1·070 (after removal of hydrocyanic acid, 1 043 to 1·049). Soluble in 300 parts of water; in alcohol and in ether in all proportions; also in nitric acid, at the ordinary temperature, without the evolution of nitrous fumes. When heated to 80° C. the oil should yield no distillate having the odour or characteristics of chloroform or alcohol. Nitro-benzol or *oil of mirbane*, which has a somewhat similar odour, has a S.G. of 1·18 to 1·21, and by nascent hydrogen yields aniline, which, by oxidising agents, gives a purple colour; advantage may be taken of this reaction for its detection. An *artificial benzaldehyde* is not infrequently used in perfumery, being cheaper than the essential oil of almonds, and more agreeable and less dangerous than nitro-benzol. Essential oil of Almonds should be carefully stored since it is rapidly oxidised to benzoic acid on exposure to the air.

Note.—Ol. Amygdalæ Persic. and Ol. Amygdal. Essent. Persic. are the fixed and volatile oils respectively of the kernels of the peach and apricot. Oil of almonds is frequently distinguished from these oils by being described as "English," since the bulk of it has hitherto been pressed in this country. The kernels of the peach and apricot are with difficulty distinguished from those of the almond, and the oils obtained from them closely resemble the so-called English (but much more expensive) oil.

AMYGDALA DULCIS.—Sweet Almond.

The ripe seed of Prunus Amygdalus, *Stokes*, *var.* dulcis, *Baillon* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 99]. It is known in commerce as the Jordan almond.

N.O.—Rosaceæ.

Habitat.—Sicily, Italy, Spain, etc.

B.P. Characters.—About an inch (two and a half centimetres) or somewhat more in length, nearly oblong in outline, more or less compressed, pointed at one extremity, rounded at the other. The testa is cinnamon-brown, thin, and rough. The seed is exalbuminous and contains two large plano-convex oily cotyledons. It has a bland taste, and when triturated with *water* forms a white emulsion without any marked odour.

The botanical characters of the two varieties of almonds are nearly identical, the chief differences lying in the size and shape of the fruit (a drupe), thickness of shell, and taste of kernel. The mesocarp is not succulent and the endocarp is woody. The official sweet almonds known as Jordan almonds are imported from Malaga, other varieties of less value come from Valencia, Sicily, and Barbary. When deprived of the testa, they are called "blanched" almonds.

Chemistry.—Fixed oil (50 per cent.), *see* Oleum Amygdalæ; sugar and gum (5 to 10 per cent.); protein (24 per cent.); inorganic salts (5 per cent.); and *emulsin*. There being no amygdalin present in sweet almonds, neither benzaldehyde nor hydrocyanic acid are obtained when the seeds are moistened with water.

Uses, etc.—Sweet almonds are used for preparing the fixed oil of almonds, and constitute the basis of some "diabetic foods."

B.P. Preparations.

Oleum Amygdalæ (*for preparations see under* Amygdala Amara).

Pulvis Amygdalæ Compositus - - 8 parts in 13.

Which is used in preparing

Mistura Amygdalæ Composita.

CYDONIÆ SEMINA.—Quince Seeds.

—The seeds of Pyrus Cydonia *Linn.* (Cydonia vulgaris).

N.O.—Rosaceæ.

Habitat.—Europe.

Characters.—About a quarter of an inch long, oval or oblong; triangularly compressed, brown, covered with a whitish, mucilaginous epithelium, causing the seeds to cohere to one another. With water the seeds swell up, and form a mucilaginous mass. The unbroken seeds have an insipid taste and no odour.

Chemistry.—Contains a mucilaginous principle called *cydonin* (20 per cent.). It differs from arabin in not being precipitated by borax, and from bassorin and cerasin by being soluble in hot and cold water.

Uses, etc.—Quince seeds yield a strong soluble mucilage; for this purpose they were formerly official in the U.S.P.

The *B.P.C.* includes formulæ for a decoction and mucilage of Quince Seeds.

JAMBUL.—Jambul.—The seeds of Eugenia Jambolana, *Linn.* (Syzygium J.)

N.O.—Myrtaceæ.

Syn.—Jambul, Jamun.

Habitat.—India and East Indies.

Characters.—Oval, about half an inch long and one-sixth inch diameter, blackish-grey, hard and heavy.

Chemistry.—*Antimellin* (a glucoside), resin, gallic acid, etc.

Uses, etc.—In diabetes; the fresh seeds are stated to be much superior in medicinal activity.

CAFFEA.—Coffee.—The roasted albumen of the seeds of Coffea arabica, *Linn.* and C. liberica, *Hiern.*

N.O.—Rubiaceæ.

Habitat.—Western Africa (and cultivated).

Characters.—The fruit is "inferior," roundish, at first green, then red, and ultimately purple; about the size of a cherry, succulent, and containing two seeds. *Mocha coffee* which, when raw, occurs in small and dark yellow grains is considered the best; *Ceylon* and *West Indian* kinds are of a bluish or greenish grey tint. All should be hard, tough, and almost tasteless and inodorous. Roasting the "berries" until they become friable, develops the characteristic bitter aromatic taste and fragrant odour. The term *coffee berry* is a misnomer, since this term cannot accurately be applied even to the fruit.

Chemistry of Roasted Coffee.—The composition is variable, depending upon the extent to which the coffee has been roasted. It contains fixed oil (12 to 20 per cent.), aromatic oil, *caffeine* (1 to 2 per cent.), tannic acid, *caffeic acid*, protein (13 per cent.), gum and sugar (15 per cent.), and mineral matter (4 to 5 per cent.), the greater part of which is soluble in water. Silica and starch are absent. The peculiar odour of roasted coffee is due to the development during the process of roasting of an empyreumatic oil, *caffeol* ($C_8H_{10}O_2$). Coffee is frequently adulterated with roasted chicory, wheat, beans, acorns, etc. For the detection of these the microscope is useful, since the structure of genuine coffee is characteristic.

Uses, etc.—A powerful nervous stimulant, coffee, in the form of infusion or decoction, is widely used as a beverage. Although its active principle is identical with that of tea, the action of coffee upon the system differs somewhat from that of the former. The difference has been variously ascribed to the decomposition changes which coffee undergoes during roasting, and to the action of the volatile constituents present in the "berries." Fluid extracts of green and of roasted coffee, also a syrup, are included in the N.F.

Note.—For caffeine see under *tea*. The leaves of the coffee plant also contain caffeine, and are used by the Malays for preparing a beverage similar to tea.

PEPO.—Pumpkin Seed.—The prepared seed of Cucurbita maxima, *Duchesne* (C. Pepo).

N.O.—Cucurbitaceæ.

Habitat.—Tropical Asia and America.

Characters.—About three-quarters of an inch long, broadly ovate, flat, white or whitish, nearly smooth, with a shallow groove parallel to the edge; containing a short conical radicle and two flat cotyledons; inodorous, bland, oily.

Chemistry.—Fixed oil (44 per cent.), starch (32 per cent.), traces of volatile oil, resin and sugar.

Uses, etc.—A tænituge; the ripe seeds freed from coats are official in the Indian and Colonial Addendum.

Note.—The seeds of CUCUMIS MELO (the melon), of CUCUMIS SATIVUS (the cucumber), and of CITRULLUS VULGARIS (the water melon), have much the same constitution as the above, and also have anthelmintic properties.

STROPHANTHI SEMINA—Strophanthus Seeds.

—The dried ripe seeds of Strophanthus Kombé *Oliver* [*Icon. Plant.* plate 1098], freed from the awns.

N.O.—Apocynaceæ.

Syn.—Kombé Seeds.

Habitat.—Tropical Africa.

B.P. Characters and Tests.—Oval acuminate seeds, about three-fifths of an inch (fifteen millimetres long) and one-sixth of an inch (four millimetres) broad, of a greenish-fawn colour, and covered with silky appressed hairs. The seeds are flattened, narrowed towards the base, which is obtuse, and provided on one side with a longitudinal ridge running from the centre to the apex of the seed. The nucleus is white and oily; the cotyledons are straight and surrounded by a thin endosperm. *Sulphuric acid* colours the latter, and sometimes the cotyledons, dark green (presence of strophanthin). The odour is characteristic; the taste very bitter.

The seeds are sometimes imported in the follicles, which are linear-oblong, 8 to 12 inches in length and pointed; usually, however, the drug is met with in the form of awnless seeds.

Chemistry.—A glucoside, *Strophanthin* $C_{31}H_{48}O_{12}$, or $C_{30}H_{46}O_{12}$ (Thoms), about 8 per cent., *kombic acid*, and fixed oil (25 to 30 per cent.).

Uses, etc.—As a cardiac tonic.

B.P. Preparations.

Extractum Strophanthi (contains milk sugar; 1 of seeds is equal to 2 of extract).

Tinctura Strophanthi - 1 in 40 of alcohol (70 per cent.)

Note.—For method of assay of tincture see *Phar. Jour.*, 4th series, iii. 463.

Varieties and substitutions of Strophanthus.—S. KOMBE was formerly supposed to be a variety of S. HISPIDUS (of West Africa), the seeds of which are brown, and, like the official drug, yield a green colour with sulphuric

acid, it is now however regarded as a distinct species. S. GRATUS also yields a brown seed, glabrous and giving yellowish-pink reaction with sulphuric acid, the seeds contain a glucoside gratus-strophanthin identical with *ouabaïn* and considerably more toxic than Kombé-strophanthin. It is from this species that the arrow poison known as *inêe* or *onage* is obtained.

The seeds of S. NICHOLSONI or Woolly Strophanthus are covered with long white hairs, give a distinct red colour with sulphuric acid and are notably less active than the official variety. S. DICHOTOMUS, S EMINI, S. COURMONTII VAR. KIRKII, and S. COURMONTII VAR. FALLAX, also yield seeds which have at one time or another come into commerce as adulterants or substitutes for the official variety. The seeds of FUNTUMIA (KICKSIA) AFRICANA are awnless, spindle-shaped and tapered at both ends.

Note.—For fuller information on this subject, *see* "The Commercial History of Strophanthus," *Holmes, P.J.*, 4, xxii., p. 312.

STROPHANTHINUM, defined as a glucoside, or mixture of glucosides obtained from Strophanthus, is official in the U.S.P. It is a whitish crystalline powder freely soluble in water and giving a green coloration with sulphuric acid. Warmed with dilute acids it is readily hydrolized into *Strophanthidin* and a sugar.

NUX VOMICA.—Nux Vomica.

—The dried ripe seeds of Strychnos Nux-vomica, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 178.]

N.O.—Loganiaceæ.

Syn.—Poison-nut ; Semen strychni.

Habitat.—East Indies.

B.P. Characters.—Nearly disc-shaped, ash-grey, or greenish-grey seeds, three-quarters of an inch to one inch (two to two and a half centimetres) in diameter, and a quarter of an inch (six millimetres) in thickness. They are concavo-convex, nearly flat, but sometimes irregularly bent, rounded or somewhat acute at the margin, where there is a small prominence from which a raised line passes to the central hilum. The surface is covered with short, satiny, radiately arranged and closely appressed hairs. The endosperm is large and horny, the cotyledons small and leafy. The seeds have an extremely bitter taste. Unbroken, they have no odour.

The seed may be best examined by softening in hot water ; it may be then divided into two discs of albumen, enclosing, near the margin, a thin, leafy embryo, the position of which is indicated by a minute depression at the circumference, corresponding to the extremity of the radicle (and the chalaza). In the centre of the concave side is the hilum, with a more or less projecting line passing from it to the margin. The embryo is about three-eighths of an inch long, the cotyledons cordate or ovate and acute.

Chemistry.—The alkaloids, *strychnine* ($\frac{1}{2}$ to 2 per cent.), *brucine* ($\frac{1}{2}$ to 3 per cent.), in combination with *igasuric* or *strychnic acid*, forming igasurates ; sugar (6 per cent.), which reduces Fehling's solution ; protein, fat (4 per cent.) and *loganin*, a

glucoside. Strychnine is not coloured by strong sulphuric acid, and but slightly by strong nitric acid in the cold. Brucine, by nitric acid, is turned to a blood-red colour, which becomes violet on the addition of stannous chloride.

The U.S.P. requires a yield of not less than 1·25 per cent. of strychnine from the seeds.

Uses, etc.—Nux Vomica is largely used both in the form of galenical preparations, and as a source of strychnine. It is a powerful spinal nerve tonic and highly poisonous. *Dose* (in powder) 1 to 4 grains.

B.P. Preparations.

Extractum Nucis Vomicæ Liquidum (1·5 per cent. of Strychnine)—*from which are prepared*

Extractum Nucis Vomicæ, 5 per cent. Strychnine.
Tinctura Nucis Vomicæ, 0·25 per cent. Strychnine.

Strychnina—*from which are prepared*

Strychninæ Hydrochloridum—*used in preparing*

Liquor Strychninæ Hydrochloridi - 1 per cent.
Syrupus Ferri Phosphatis cum Quinina et Strychnina, 1 in 1760 parts.

Preparations other than B.P.—These are very numerous, comprising a fluid extract and tincture of the seeds (U.S.P.), salts of strychnine, *e.g.*, nitrate and sulphate (U.S.P.), the scale preparations, citrate of strychnine with iron, and with iron and quinine, and a large variety of syrups; many such formulae are contained in the B.P.C.

Note.—The liquid extract and the tincture of Nux Vomica are *standardized preparations, i.e.*, definite volumes must contain a fixed quantity of alkaloid. This provision, made during the last few years, is highly necessary, since formerly preparations of this drug were very variable in strength and hence either dangerous or useless. The preparations of the 1898 British Pharmacopœia are standardized to contain a definite proportion of strychnine instead of total alkaloids as in the 1885 edition. The 1898 tincture contains about twice the proportion of strychninė present in the older preparation.

Strychnine ($C_{21}H_{22}N_2O_2$).—To prepare this alkaloid the seeds are reduced to powder by drying for many hours at a temperature of 100° C. (212° F.) and grinding, the powder is exhausted by spirit mixed with half its weight of water. The liquor is filtered and evaporated to remove alcohol, and to the product acetate of lead is added until no further precipitate of tannin and colouring matters is obtained. Excess of lead is removed by hydrogen sulphide and the filtrate concentrated by evaporation. The bases are next thrown down by ammonia, collected, dissolved in alcohol, and separated by crystallization. The strychnine separates out first, leaving brucine in the mother liquor.

Strychnine so obtained crystallizes in trimetric prisms. It dissolves in 180 parts of amyl alcohol, in 5 parts of chloroform, and is nearly insoluble in water, to which, however, it lends a bitter taste. It gives the reactions common to alkaloids, and may be detected in quantities as small as 0·00001 gram by the following test:—If to a solution in strong sulphuric acid an oxidising agent, such as potassium bichromate or peroxide of lead be added, a blue colour changing through purple to crimson and brick red is produced. If brucine be absent a solution of strychnine in nitric acid should be colourless or very faintly yellow. The following salts of strychnine have been prepared:—Sulphate, acetate, hydriodide, hydrobromide, hydrochloride, and nitrate. The hydrochloride ($C_{21}H_{22}N_2O_2,HCl,2H_2O$) is official.

IGNATIÆ SEMINA.—Bean of St. Ignatius.—The seed of Strychnos Ignatia, *Lindl.*

N.O.—Loganiaceæ.

Syn.—Faba Ignatii.

Habitat.—Phillipine Islands.

Characters.—About one and a fifth inch long, oblong or ovate, irregularly angular, dull brownish or blackish, covered with silvery appressed hairs, very hard, horny; fracture granular, irregular; the albumen somewhat translucent, enclosing an irregular cavity with an oblong embryo; inodorous; very bitter. About twenty seeds are contained in each pyriform fruit.

Chemistry.—The same as Nux Vomica; the strychnine being present in somewhat greater quantity.

Uses, etc.—Much the same as Nux Vomica; official in Fr. Codex. An extract and tincture (B.P.C.) are prepared from the beans.

Note.—Other species of Strychnos are—S. POTATORUM (the Indian *Nirmulee*), used by the Hindoos for clearing muddy water, which they effect by means of the albumen the seeds contain. S. COLUBRINA, yielding *lignum colubrinum* S. GAULTHERIANA, the source of the Chinese *Poang-nan*. *Akazga* (*Bourdu*), an African drug, is also said to be derived from an unknown species of Strychnos.

STRAMONII SEMINA.—Stramonium Seeds.—The dried ripe seeds of Datura Stramonium, *Linn.*

N.O.—Solanaceæ.

Syn.—Thornapple Seed.

Habitat.—Britain.

B.P. Characters.—Dark brown or nearly black seeds, about one-sixth of an inch (four millimetres) long, reniform in outline, flattened. The surface is marked with reticulate depressions and is also minutely pitted. The embryo is curved and embedded in a white oily albumen. The seeds have no marked odour, but a slightly bitter taste.

Chemistry.—The alkaloids *atropine* and *hyoscyamine* are present to the extent of less than 0·5 per cent., and *scopolamine* (*hyoscine*) is also stated as being contained in small proportion. The *daturine* formerly described as a constituent is now known to be atropine. *Malic acid* and *fixed oil* (25 per cent.) are also present.

Uses, etc.—As an antispasmodic; stramonium dilates the pupil of the eye.

B.P. Preparation.

Extractum Stramonii - - - alcoholic.

The *B.P.C.* also includes Unguentum Stramonii.

Note.—The seeds of DATURA ALBA (*Dhatura*) D. FEROX, D. METEL, and D. FASTUOSA are used in India, and are said to have much the same composition as the official drug. The two latter are official in the Indian and Colonial Addendum. *Bethene* is an African variety of Datura. The Chinese drug, *Nau yeung fa* or *Mán t'o lo fa*, consists of the flower heads of Datura alba, grown in China, where it is used as a soporific. The alkaloid present is said to be *hyoscine* (*scopolamine*) only.

HYOSCYAMI SEMINA.—Hyoscyamus Seeds.—The seeds of Hyoscyamus niger, *Linn.*

N.O.—Solanaceæ.

Syn.—Henbane Seeds.

Habitat.—Europe and Asia.

Characters.—One sixteenth of an inch in length, roundish, reniform, flattened; testa of a grey-brown colour, finely and densely pitted; albumen oily, whitish, enclosing an embryo curved like the figure 9; inodorous, taste oily, bitter, and somewhat acrid.

Chemistry.—Fixed oil (25 per cent.), resin, mucilage, protein, *hyoscyamine*, and *hyoscine* (total alkaloid about 0·058 per cent.)

Uses, etc.—Formerly official in several countries, now find use chiefly as a source of the alkaloid.

Note.—Belladonna seeds are of much the same size and shape, but are red-brown in colour.

SESAMUM.—Benne Seed.—The seeds of Sesamum indicum, *Linn.*

Syn.—Gingelli seeds.

Habitat.—Southern Asia.

Characters.—Small, flattened, oval or ovate, varying in colour between whitish-yellow, reddish-brown and blackish; finely punctuate, and having four delicate longitudinal ridges; embryo straight, with plano-convex oily cotyledons.

Chemistry.—Fixed oil (50 to 56 per cent.), protein and mucilage.

Uses, etc.—For preparing Sesamé Oil.

Sesami Oleum, Sesame Oil (*syn.*—Benné oil, teel oil, gingili oil) is a yellow, limpid oil, with a bland and agreeable taste. S.G. 0·921 to 0·924, congealing point—5°C. This oil consists mainly of *olein* (about 75 per cent.) together with *myristin*, *palmitin*, *stearin*, and a resin-like body. It is official in the Indian and Colonial Addendum for use in place of olive oil.

Note.—Sesamé oil may be distinguished from cotton-seed oil by giving a white mixture with an equal volume of nitric acid which, after standing from 12 to 18 hours, is still liquid (cotton-seed oil, when this test is applied, becomes yellowish-brown in colour, and finally semi-solid in consistence). A characteristic test for sesamé oil made use of in detecting its presence in olive oil is as follows:—10 cc. shaken for ten minutes with 5 cc. of hydrochloric acid (S.G. 1·16), in which one-tenth gramme sugar has been dissolved, produces a rose-tint in the acid layer.

MYRISTICA.—Nutmeg.—The dried seed of Myristica fragrans, *Houtt.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 218], divested of its testa.

N.O.—Myristicaceæ.

Syn.—Nux Moschata.

Habitat.—Banda Islands of the Malayan Archipelago.

B.P. Characters.—Oval or rounded, varying in length, but rarely exceeding an inch (twenty-five millimetres); greyish brown externally, and marked with reticulated furrows; internally greyish-red with darker brownish-red veins, so that the transverse section has a marbled appearance. Odour strong and pleasantly aromatic; taste agreeably aromatic, warm, and somewhat bitter.

The fruit of the nutmeg tree is a pendulous globose drupe, consisting of a succulent pericarp, an arillus (mace) covering the hard endocarp, and a wrinkled kernel with ruminated albumen. After the removal of the mace, the seeds are placed on hurdles or gratings and smoke-dried at 140° F., for about two months, by a slow wood fire. When dry they rattle in the shells, which are then cracked, and the bad kernels rejected. The Dutch nutmegs are usually covered with lime. The order of value is as follows:—(1) Penang; (2) Dutch; (3) Singapore; (4) Long nutmegs. (*See* foot-note).

Chemistry.—Fat or expressed oil (25 per cent.); volatile oil (8 to 15 per cent.); starch and protein.

Uses, etc.—Nutmegs are used in medicine as a stimulant and stomachic, and largely also for flavouring purposes.

Oleum myristicæ expressum, the fixed oil, erroneously called "oil of mace," is a concrete oil obtained by expression and heat from nutmegs (usually those too small for sale). It is imported from Singapore in oblong blocks, ten inches by two and a half square, enveloped in palm leaves. It is soluble in 4 parts of warm alcohol, S.G. 0·800, and in ether. It contains 6 per cent. of volatile oil and 50 per cent. of *myristin* (myristicate of glyceryl), besides resin and other fats.

B.P. Preparations.

*Oleum Myristicæ.
Pulvis Catechu Compositus.
,, Cretæ Aromaticus.
,, ,, ,, c Opio.
Spiritus Armoraciæ Compositus.
Tinctura Lavandulæ Composita.

**Used in the preparation of* Pilula Aloes Socotrinæ, Spiritus Ammoniæ Aromaticus, Tinctura Guaiaci Ammoniata, Tinctura Valerianæ Ammoniata and Spiritus Myristicæ†

†*Occurs in* Mistura Ferri Composita.

B.P.C. Preparations.—Confectio Aromatica, Confectio Guaiaci Comp., Pulvis Aromaticus Comp.

Note.—Myristica fatua (wild or male nutmegs—wild mace) has seeds the kernels of which constitute the *long nutmegs* of commerce. These are much longer and more cylindrical than the official kind, and possess the odour of nutmegs; they also have an arillus, yielding a mace which is insipid, and almost without odour. Torreya Californica, a South American coniferous plant, is the source of the so-called *Californian nutmeg*. These are oblong and marbled in section, but their odour is distinctly terebinthinous. The *Jamaica* or *Calabash nutmeg*, from Monodora myristica, the *New Holland* or *plume nutmeg*, from Atherosperma moschata, and the *clove nutmeg*, from Agathophyllum aromaticum, are not true nutmegs.

CROTONIS SEMINA.—Croton Seeds.

—The ripe seeds of Croton Tiglium, *Linn.*

N.O.—Euphorbiaceæ.

Syn.—Tiglium seeds.

Habitat.—India.

Characters.—Half an inch long, quadrangular, quarter of an inch broad, with the raphe along ventral side; the surface of a dull brown colour

which, when removed, discloses a black brittle testa; beneath this is a silky endopleura, enclosing an oily kernel; the cotyledons, of which there are two, are large, flat, and veined, the embryo lying at the thicker end of the seed. Odourless; taste at first oily, but afterwards acrid and burning.

Chemistry.—Fixed oil 50 to 60 per cent. (*see* Oleum Crotonis), *toxic proteins*, and ash 3 per cent.

Uses, etc.—For preparing Croton Oil.

Note.—The seeds of CROTON OBLONGIFOLIUS (Calcutta), CROTON PAVANÆ (Assam), and those of CROTON POLYANDRUM are employed as purgatives, but are not so strong as the official.

RICINI SEMINA.—Castor Seeds.—The seeds of Ricinus communis, *Linn.*

N.O.—Euphorbiaceæ.

Syn.—Semina Palmæ Christi.

Habitat.—Indigenous to Southern Asia (and cultivated).

Characters.—The seeds, which are contained in a subglobular, somewhat triangular, grooved, smooth or mostly spiny tricoccous capsule, are oval, somewhat flattened, smooth, shining, of a grey colour, variegated with yellowish brownish, or reddish spots and lines, with a slightly raised raphe along the flattish side, and a prominent caruncle or strophiole near one end. The embryo is straight, and has foliaceous heart-shaped cotyledons, and is embedded in an oily albumen, having a bland and slightly acrid taste. They are distinguished from Croton Seeds by being larger, more shining, having a mottled testa, and a more prominent caruncle.

Chemistry.—Fixed oil (50 per cent.) [*see* Oleum Ricini]; protein (20 per cent.); sugar and mucilage (2·2 per cent.) A body called *ricinine* has also been obtained from the seeds; originally described as an alkaloid, its claim to that title has since been disputed, and it has even been regarded has a magnesium salt, more recently it has been shown to be a pyridine derivative. The seeds, after the removal of the oil, are violently purgative, a property which is said to be due to the presence of a ferment (tox-albumin) which has been called *ricin*.

Uses, etc.—For obtaining Castor Oil.

Note.—The seeds of OMPHALEA OLEIFERA and O. MEGUACARPA both yield oils possessing purgative properties. The former under the name of Jamboe oil obtains use in Central America. (*N.O.*—Euphorbiaceæ).

CURCAS.—Purging Nut.—The seed of Curcas purgans, *Adans.* (Jatropha Curcas),

N.O.—Euphorbiaceæ.

Syn.—Semen ricini majoris, Barbadoes nuts, purging nuts.

Habitat.—Tropical America.

Characters.—About four-fifths of an inch long, ovate-oblong, with broad whitish hilum and caruncle at one end; dull black in colour; marked with numerous small cracks.

Chemistry.—Fixed oil 40 per cent., tox-albumin *curcin*, protein and acrid resin.

Uses, etc.—The oil has properties similar to those of croton oil, but it is less powerful.

PARADISI GRANA.—Grains of Paradise.—The seeds of Amomum Melegueta, *Roscoe*.

N.O.—Scitamineæ.

Syns.—Guinea Grains, Melegueta Pepper; Amomi Semina.

Habitat.—West Africa.

Characters.—Small, roundish, or of an ovate form, and often angular or somewhat cuneiform; the testa is pitted and wrinkled; externally brown or reddish brown; paler at the pointed (hilum) end; white within; of a feeble aromatic odour, and a strongly hot and peppery taste. They may be distinguished from Colchicum seeds by their size, shape, colour, and by the membranous tuft at the base of the seed.

Chemistry.—Volatile oil 0·3 per cent., tannin, fat, starch, resin, gum, and *paradol;* the latter, the active principle, is a viscid, pungent, straw-coloured fluid.

Uses, etc.—For cattle medicines and for imparting artificial strength to alcoholic beverages.

COLCHICI SEMINA.—Colchicum Seeds.—

The dried ripe seeds of Colchicum autumnale, *Linn.*

N.O.—Liliaceæ.

Syn.—Meadow-saffron seeds.

Habitat.—Indigenous.

B.P. Characters.—About one-tenth of an inch (two and a half millimetres) in diameter, subglobular, slightly pointed at the hilum, rough and of a dull reddish-brown colour, minutely pitted, very hard and tough. The endosperm is oily; its cells are seen in transverse section to have thickened walls with large pits. The seeds have a bitter acrid taste, but no odour.

Chemistry.—Fixed oil, gum, starch, sugar, *colchicine* (0·4 to 0·6 per cent. The U.S.P. requires not less than 0·55 per cent.). *Colchiceine* is probably a decomposition product of the action of an acid solvent upon Colchicine.

Colchicine ($C_{22}H_{25}NO_6$) is an amorphous, colourless or pale-yellow alkaloid, soluble in alcohol and chloroform, and coloured yellow in solution by hydrochloric acid Colchicine is the methyl ester of *aceto-trimethyl-colchicinic acid* (colchiceine) and has been built up synthetically. The alkaloid forms a crystalline compound with chloroform.

Uses, etc.—In rheumatism and similar disorders.

B.P. Preparation.

Tinctura Colchici Seminum	-	1 part in 5 of alcohol (45 per cent.)

B.P.C. Preparations.—Tinctura Colchici Comp., Vinum Colchici Seminis.

SABADILLA.—Cevadilla.—The dried ripe seed of Schœnocaulon officinale, *A. Gray* (Asagræa officinalis, Veratrum officinale). The seeds are sometimes imported contained in, or mixed with, their pericarps, but these should be rejected before the seeds are used.

N.O.—Liliaceæ.

Syn.—Cebadilla.

Habitat.—Mexico.

Characters.—About one quarter of an inch or less in length, narrow, fusiform, or somewhat scimitar-shaped, prolonged above into a membranous wing, somewhat compressed, shining, wrinkled, blackish-brown, Taste bitter, acrid; inodorous, but when powdered producing violent sneezing.

Chemistry.—Fat (containing a volatile fat acid, *sabadillic* or *cevadic acid*), wax, mucilage, *veratric (dimethyl protocatechuic) acid* ($C_6H_3(OCH_3)_2COOH$) and the following bases—*Veratrine* ($C_{37}H_{53}NO_{11}$, decomposable into veratric acid and *verine*), *cevadine* ($C_{32}H_{49}NO_9$, decomposable into cevadic acid and *cevine*) and *cevadilline* ($C_{34}H_{53}NO_8$). Two other alkaloids, *sabadine* and *sabadinine*, are reported to have been isolated from Sabadilla.

Note.—The alkaloid *Veratrine* has been called *Veratridine* to distinguish it from the mixture of bases described as *Veratrine*.

Veratrina P.B. is a mixture of several or of all of the alkaloids present in Cevadilla and their decomposition products. It may be prepared by exhausting the powdered seeds with alcohol, removing (by distillation) the spirit from the solution so obtained, mixing the resulting concentrated solution with twelve times its volume of water, filtering and precipitating the aqueous solution with ammonia. The crude alkaloidal residue is then purified by dissolving it in hydrochloric acid, treating the solution with animal charcoal, and finally re-precipitating with ammonia, washing and drying. Thus obtained, Veratrine consists of pale, grey, amorphous, pulverulent masses, powerfully irritating the nostrils, strongly and persistently bitter, highly acrid and poisonous. It is soluble in three parts of chloroform and rectified spirit; in six parts of ether, and only slightly in water even when boiling. It dissolves in nitric acid, yielding a yellow solution; in sulphuric acid, forming a deep red solution having a green fluorescence by reflected light, and in warm hydrochloric acid with the production of a blood-red colour. Heated with access of air it melts into a yellow liquid and burns away leaving no residue.

B.P. Preparation.

Unguentum Veratrinæ - - - 1 in 50.

B.P.C. Preparations.—Collodium Anodynum, Oleinatum Veratrinae.

ARECÆ SEMINA.—Areca Nuts.—The seed of Areca Catechu, *Linn.*

N.O.—Palmaceæ.

Syn.—Betel Nut.

Habitat.—East Indies.

Characters.—The seed is about an inch long, roundish conical in shape, and somewhat depressed at the base. It is of a brown colour externally, with numerous reddish veins originating in the hilum and forming a network which penetrates into the white albumen; the small embryo is situated near the base of the seed. The seeds are heavy, very hard, and have when recently broken a feeble, somewhat cheese-like odour, and an astringent and slightly acrid taste. These "nuts," with unslacked lime and the leaves of the Betel pepper, form the celebrated masticatory of the East called *betel*. The albumen of the seeds is ruminated, but they differ from nutmegs in having a flat base.

Chemistry.—Fixed oil (14 per cent.), tannin (10 to 15 per cent.) and four alkaloids, viz.:—*Arecoline* ($C_8H_{13}NO_2$), *arecaine* ($C_7H_{11}NO_2$), *arecaidine* and *guvacine*. *Arecoline Hydrobromide* is official in the German Pharmacopœia. An aqueous extract of the seeds yields a kind of Catechu.

Uses, etc.—As a tænifuge, and on account of its astringent qualities as an ingredient of dentifrices. Areca charcoal is said to have distinctive properties. *Dose.*—For a dog, 60 grains.

2. ROOTS.—RADICES.

General Morphology of the Root—The root is the descending and normally subterranean axis of the plant. When, as is frequently the case in dicotyledons, the radicle of the embryo elongates into a *primary* root, this becomes the root axis of the growing plant; but when, as in all monocotyledonous plants, the growth of the radicle ceases soon after the germination of the seed, the base of the shoot gives rise to a number of roots which, on account of their origin, belong to the class of so-called *secondary* or *adventitious* roots. Adventitious roots are found growing not only at the base of aërial shoots, but also as the rootlets of rhizomes, stolons, runners, etc.

Roots by duration are *annual*, *i.e.*, dying away at the end of one year's growth; *biennial*, *i.e.*, living for two years; or *perennial*, *i.e.*, living on indefinitely from year to year. Both biennial and perennial roots commonly contain some stored food for the use of the plant. Subterranean roots possess very various forms, the most common of which are the simple, somewhat conical, and more or less branched *tap* roots of many dicotyledons, and the more or less thread-like *fibrous* roots of all monocotyledons. Tap roots of biennial and perennial growth differ widely in form, *e.g.*, they may be *conical* (aconite), *fusiform* (radish), *napiform* (turnip), *tuberous* (jalap), *fascicled* (dahlia), *annular* (ipecacuanha). Aërial roots, *e.g.*, *climbing* (ivy), *epiphytic* (certain orchids), *parasitic* (mistletoe) are rarely met with in medicine.

Histology of the Root.—The roots which are made use of in medicine are, in the great majority of cases, the "secondarily-thickened" roots of dicotyledons and differ entirely from the young root, the piliferous and primary cortical layers of which have long since sloughed off and been replaced by a jacket of cork. A transverse section of a typical dicotyledonous root, which has undergone secondary thickening, shows the following arrangement of the tissues:—Externally we find the cork layer or *periderm* enclosing an almost continuous ring of tissue, mostly parenchyma, the thickness of which will vary according to the age of the root, and which constitutes the so-called *bast*, *phloëm* or *secondary cortex*. Internally to the bast lies the *cambium* ring, showing as a fine line of tissue and separating the bast from the *wood* or *xylem* which is arranged in wedge-shaped groups. Passing at right angles through the bast and wood, and appearing in section as radiating lines, are certain cellular plates, the so-called *medullary rays*. In the centre of the section will be a small column of pith, or, as is commonly the case with the older roots, the pith will have disappeared and the section will show a central speck around which the xylem groups

are arranged. In tuberous roots *(vide supra)* the characteristic swelling takes place by the increase of the parenchymatous tissue, the cells of which become filled with stored food material. In addition to the above-mentioned fundamental tissues of roots, those made use of in medicine frequently possess *laticiferous tubes, vesicles, sacs*, and other *secretory reservoirs* which are the receptacles of those various secretions to which these roots owe their medicinal value.

General Chemical Characters of Roots.—In addition to such substances as cellulose, lignin, suberin, etc., present alike in roots and in all other complex masses of vegetable tissue, the former frequently contain other carbohydrates, the commonest form of which is starch. Amongst the Compositæ, however, inulin, and in many other roots some form of sugar, answers the purpose of reserve food material. Vegetable mucus or gum, produced probably by the chemical alteration of the cell-walls, is a characteristic constituent of Malvaceous roots. The contents of the laticiferous vessels and other secretory reservoirs furnish the resins, gum-resins, alkaloids, glucosides, etc., which constitute the active principles of the medicinal roots. The chemical principles of roots may show considerable variation according to the time of year when the roots are collected, *e.g.*, dandelion roots collected in autumn contain a large proportion of inulin which takes the place of sugar present in spring and summer.

ACONITI RADIX.—Aconite Root.

—The root of Aconitum Napellus, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 6]. collected in the autumn from plants cultivated in Britain and dried.

N.O.—Ranunculaceæ.

Syn.—Monkshood; Wolfsbane.

Habitat.—Germany, or cultivated in Britain.

B.P. Characters.—Aconite Root varies usually from two to four inches (five to ten centimetres) in length, and from one-half to three-quarters of an inch (twelve to eighteen millimetres) in diameter at the upper extremity, gradually tapering below. Dark brown in colour, marked with the scars and bases of broken rootlets and crowned with the remains of an undeveloped bud. Fracture short. Internally the root is whitish and starchy. It should not be hollow or spongy, and should not retain any portions of the stem. The transverse section exhibits a thick parenchymatous cortex and a large stellate pith with about seven projecting angles; the groups of vessels are small and few in number. No marked odour; taste at first slight, followed by a persistent sensation of tingling and numbness in the mouth.

Note.—The name Aconite is derived from the Greek, ἀκων—a dart.

Chemistry.—Alkaloid from 0·3 to 1·0 per cent. and consisting of *aconitine (nap-aconitine)* crystalline, acrid and highly toxic; with the amorphous alkaloids *benzaconine (picraconitine)* and *aconine*. Aconitine, the only crystallizable alkaloid, is present to the extent of not more than 0·2 per cent., but to it is probably due the characteristic activity of the root, since the other alkaloids are but little poisonous in comparison with it. The U.S.P. has a standard of not less than 0·5 per cent. of "aconitine," this term including total ether-soluble alkaloid.

Uses, etc.—Aconite root is largely used in medicine, chiefly as an anodyne and antipyretic; it is highly poisonous.

B.P. Preparations.

*Aconitina.

Linimentum Aconiti, 2 parts in 3 of alcohol (90 per cent.)
Tinctura Aconiti - 1 part in 20 of „ (70 „)

**Used in preparing* Unguentum Aconitinæ, 1 in 50.

Preparations other than B.P.—Of these there are many, including fluid extract and tincture (U.S.P.), alcoholic extract (Fr. Codex), together with Chloroformum Aconiti, Tinctura Aconiti Fortis (Fleming's tincture), Linimentum Aconiti Comp. and Linimentum Aconiti et Chloroformi of the B.P.C.

ACONITINA P.B. ($C_{33}H_{45}NO_{12}$) is the name now applied to the above-mentioned highly toxic crystalline alkaloid, formerly known as nap-aconitine. It must not be confused with commercial aconitine, which is a mixture of the latter with other amorphous bases. The pure alkaloid occurs in colourless hexagonal prisms of the rhombic system. Melting point 372·2° to 374° F. (189° to 190° C.). Slightly above this temperature it yields acetic acid. Readily soluble in *alcohol* (90 per cent.) or *chloroform*, less readily in *ether*. Nearly insoluble in *water* and in *petroleum spirit*. An alcoholic solution of the alkaloid turns the plane of a ray of polarised light to the right. A drop of even an extremely dilute solution (not more than one-tenth per cent.) when placed on the tongue produces a persistent tingling sensation. The salts of aconitine are crystalline. The hydrochloride melts at 300·2° F. (149° C.) and the hydrobromide at 327·2° F. (164° C.). A dilute solution of the alkaloid, even 1 part in 4000 parts of *water*, faintly acidulated with *acetic acid*, deposits a red crystalline precipitate on the addition of a few drops of *solution of potassium permanganate*.

Note.—The pure crystalline aconitine may be obtained by exhausting the root with amylic alcohol, agitating the fluid with dilute sulphuric acid, separating the acid liquid, agitating with chloroform to remove resin, etc., and precipitating the bases with carbonate of sodium. The precipitate is re-dissolved in a mixture of alcohol and ether and the aconitine allowed to crystallize.

The formula given above is one of several which have been ascribed to aconitine. The latest researches tend to show that the alkaloid is *acetyl-benzoylaconine*, having the probable formula $C_{24}H_{39}NO_{10}$,CH_3CO,C_6H_5CO, and splitting up on hydrolysis into *benzaconine* (or picraconitine) and acetic acid, *aconine* and benzoic acid being subsequently formed. The readiness with which aconitine undergoes hydrolysis may be taken as accounting for the marked loss of aconitine which occurs in the preparation of those aconite galenicals requiring the application of heat.

ACONITI HETEROPHYLLI RADIX.—Atis Root.

The dried root of Aconitum heterophyllum, *Wall.*

N.O.—Ranunculaceæ.

Habitat.—Western Temperate Himalayas.

Characters.—Ovoid or spindle-shaped tuberous roots, tapering downwards to a point, and from one-fourth to half an inch in thickness. The surface, which is covered with a thin greyish epidermis, is slightly wrinkled longitudinally and marked here and there with rootlet scars. Transverse section shows it to consist of a pure white friable amylaceous substance, marked by five or six concentrically arranged dots, the terminations of threads of woody fibre traversing the root longitudinally. Inodorous, and of a bitter non-acrid taste.

Chemistry, etc.—This species does not contain aconitine and is non-poisonous. Its chief constituent is an intensely bitter alkaloid, *atisine* $C_{22}H_{31}NO_2$, having a definite composition and possessing tonic and antiperiodic properties.

ACONITI INDICI RADIX.—Nepal Aconite.—

The root of Aconitum ferox, *Wall.*

N.O.—Ranunculaceæ.

Syn.—Nepal Aconite.

Habitat.—Nepal, India.

Characters.—A conical root, not suddenly tapering, from two to four inches long, and one inch or more in diameter at its base, and much shrivelled longitudinally; of a lighter brown colour than the official variety, and at its base are often to be seen portions of the stem; the rootlet scars are much fewer than in the official root: internally hard and almost resinous; taste intensely acrid.

Chemistry, etc.—This root yields *pseudaconitine* $C_{36}H_{51}NO_{12}$ (*acetyl veratryl pseudaconine*), which is allied to aconitine, and resembles it in many of its properties. It splits up into acetic acid and *veratryl pseudaconine*, the latter finally undergoing hydrolysis into *pseudaconine* and *veratric acid*. With sulphuric acid and vanadium sulphate pseudaconitine produces a violet red colour.

Note.—The Indian "Bikh" or Bish formerly ascribed to this plant is now known to be derived from a distinct species (*see* A. spicatum).

ACONITI JAPONICI RADIX.—Japanese Aconite Root.—

The dried root of Aconitum Fischeri, *Reichb.*

N.O.—Ranunculaceæ.

Syn.—Aconitum Chinense.

Habitat.—Japan.

Characters.—Conical or top-shaped tuberous roots, one or two inches in length, and about one-third to one inch in thickness at the base. Externally covered with a light or dark brown, or greyish, closely adherent cuticle, with a few longitudinal and often some transverse wrinkles; internally white and amylaceous. The bases present distinct remains of one or more lateral stalks, and are in most specimens conical, but sometimes round, while a few are pointed. They are irregularly and scantily furnished with a few lateral rootlets, or only with the scars of these; average weight, 15 to 45 grains. Some roots do not contain much alkaloid, because of having been subjected to the process of steeping, when fresh, in a mixture of common salt, vinegar and water, and subsequently dried.

Chemistry.—The poisonous alkaloid which is present is called *japaconitine* ($C_{34}H_{49}O_9N$), to distinguish it from the official aconitine, and the pseudaconitine of A. ferox. Japaconitine is similar in constitution and in properties with the aconitine of A. napellus. It is split up on hydrolysis into acetic acid and *japbenzaconine*, the latter finally breaking up into benzoic acid and *japaconine*.

Other Varieties of Aconite.—Aconitum Chasmanthum, known in India as "Mohri," contains *Indaconitine* $C_{37}H_{47}O_{10}N$, an alkaloid yielding *Indbenzaconine* on partial and *Indaconine* on complete hydrolysis.

Aconitum Spicatum now recognised as the source of the Indian "Bikh," contains *Bikhaconitine*, resembling pseudaconitine, and yielding *Veratroylbikhaconine and Bikhaconitine* on hydrolysis.

CALUMBÆ RADIX.—Calumba Root.—

The dried transversely cut slices of the root of Jateorhiza Columba, *Miers* [*Bentl. and Trim. Med. Pl.* vol. i. plate 13.]

N.O.—Menispermaceæ.

Habitat.—Forests of Eastern Africa.

B.P. Characters.—In irregular flattish circular or somewhat oval slices, depressed towards the centre; from about an inch to two inches (two and a half to five centimetres) or more in diameter, and from one-eighth to half an inch (three to twelve millimetres) or more in thickness; more or less uniformly yellow in colour. The cork is brownish and wrinkled, the cortex thick, marked with radiating lines, and separated by a dark line from the wood, in which the vessels are arranged in narrow radially elongated groups. The parenchymatous tissue is largely developed, and contains numerous starch grains, mostly simple with eccentric hilum. The fracture is short, odour feeble, taste bitter.

Chemistry.—*Calumbin* 1 per cent. (white crystalline), *calumbic acid*, starch (33 per cent.), pectin, gum, resin, and a small quantity of wax. Three alkaloids *calumbamine*, *jateorrhizine* and *palmatine* have recently been stated to be present.

Uses, etc.—A much used tonic. *Dose.*—5 to 20 grs. in powder.

B.P. Preparations.

Infusum Calumbæ - - -	1 part in 20.
Liquor ,, Concentratus,	1 part in 2 of a mixture of alcohol and water (about 20 per cent.).
Tinctura Calumbæ - -	1 part in 10 of alcohol (60 per cent.).

B.P.C. Preparations.—Extractum Calumbæ and Infusum Calumbæ Concentratum.

Note.—Adulterations and Substitutions.—Calumba root may readily be distinguished from all its adulterants and substitutions by noting the structure, hollow centre, and abundance of starch. The following are among some of the adulterants which have been noticed:—

(1.) The slices of the root of Coscinium fenestratum (*N.O.*—Menispermaceæ. *Habitat.*—Ceylon). These are much larger and smoother than those of Calumba and have a different structure, are not hollow in the centre, and contain comparatively little starch. It is imported as "calumba wood;" its properties are similar to those of calumba, and it contains alkaloidal matter. Its decoction is not darkened as much as that of calumba by a solution of iodine. Coscinium fenestratum is official in the Indian and Colonial Addendum as a substitute for Calumba.

(2). The transversely sliced and dried root of Bryonia dioica. *White Bryony* (*N.O.*—Cucurbitaceæ. *Habitat.*—Britain). This resembles calumba root only in shape; the slices are two to four inches in diameter and one-eighth of an inch or more in thickness, externally pale greyish-brown, transversely wrinkled; internally white, with a thin bark, a brown cambium line, narrow wood-bundles and broad medullary rays, and presenting an irregular radiating appearance from the projecting wood rays. The

root is inodorous, and has a disagreeably bitter taste. A solution of iodine strikes very little or no colour when applied to the slices, indicating absence of starch.

(3). The root of FRASERA WALTERI (F. CAROLINENSIS, AMERICAN COLUMBO). (*N.O.*—Gentianaceæ. *Habitat.*—North America). It is dried in transverse slices, which are distinguishable from those of Calumba by the absence of the dark-coloured lines near the cambium and by their freedom from starch.

PAREIRÆ RADIX.—Pareira Root.

—The dried root of Chondrodendron tomentosum, *Ruiz and Pavon* [*Bentl. and Trim. Med. Pl.* vol. i. plate 11].

N.O.—Menispermaceæ.

Syn.—Pareira Brava; Wild Vine.

Habitat.—Brazil.

B.P. Characters.—In long and nearly cylindrical more or less twisted pieces, from about three-quarters of an inch to two or more inches (two to five centimetres) in diameter; covered with a thin blackish-brown bark, and marked externally with longitudinal furrows and transverse ridges and fissures. Internally yellowish or brownish-grey, with well-marked concentric or more or less eccentric crenated zones, the porous wood being separated into wedge-shaped portions by large medullary rays, and when cut presenting a waxy appearance. No odour; taste bitter.

Chemistry.—An alkaloid, *cissampeline* or *pelosine*, said to be identical with beberine (bebeerine) and buxine; a resin soluble in alcohol; starch, a yellow bitter principle, fatty substances, and brown extractive.

Uses.—Chiefly used in the form of liquid extract as a diuretic and tonic.

B.P. Preparations.

Extractum Pareiræ Liquidum, 1 of solid extractive in 4 fluid parts.

B.P.C. Preparation.—Decoctum Pareiræ.

Note.—ADULTERATIONS AND SUBSTITUTIONS.—The *stems*, which are sometimes found mixed with the roots, are lighter in colour, have lichens attached, and show their origin by possessing a small well-defined pith.

White Pareira Brava (ABUTA RUFESCENS) has a thick woody root, which exhibits numerous concentric layers, traversed by very distinct, dark, medullary rays, the interradial spaces being white and rich in starch.

Common false Pareira. Of this the botanical origin is unknown. The stems have a well-marked pith, the root very little. The arrangement of the woody zones is very eccentric, and the wavy appearance of true Pareira is absent. There is no starch present, the root is much lighter in weight and less waxy when cut than the official variety.

In the Pharmacopœia of 1867, Pareira Brava was attributed to Cissampelos Pareira but it is doubtful whether any true root of this species ever came into commerce.

ARMORACIÆ RADIX.—Horseradish Root.

—The fresh root of Cochlearia Armoracia, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 21], collected from cultivated plants.

N.O.—Cruciferæ.

Habitat.—Cultivated in Britain.

B.P. Characters.—Nearly cylindrical, except at the crown, where it is somewhat enlarged, and marked with closely approximated semi-amplexicaul leaf-scars. It is from half an inch to about an inch (twelve to twenty-five millimetres) in diameter, and commonly a foot (thirty centimetres) or more in length; pale yellowish-white or brownish-white externally, whitish within. Inodorous when unbroken, but exhaling a characteristic pungent odour when scraped or bruised; taste very pungent.

Chemistry.—The volatile oil, which is easily developed by scraping the root when in a fresh state and to which its pungency is due, is *allyl isothiocyanate* (C_3H_5CNS), and does not pre-exist in the root. It is the result of the decomposition of a glucoside by an enzyme similar to that which produces the volatile oil of mustard.

Uses, etc.—Little used in medicine, but has stimulant and rubefacient properties. Largely used in condiments.

B.P. Preparation.

Spiritus Armoraciæ Compositus - 1 in 8 fluid parts.

Note.—This root is sometimes met with in the dried state, cut obliquely into pieces, from one-half to one inch long, and about a quarter to half an inch in diameter. It is then much shrivelled, and internally is whitish, and externally yellowish-brown. It is said to have been mistaken for fresh aconite root, but this seems highly doubtful.

SENEGÆ RADIX.—Senega Root.

—The dried root of Polygala Senega, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 29].

N.O.—Polygalaceæ.

Syn.—Snake Root.

Habitat.—North America.

B.P. Characters.—Greyish or brownish-yellow slender roots, usually varying from two to four inches (five to ten centimetres) in length, enlarged at the top into a knotty crown which bears the bases of numerous slender aerial stems. The roots are frequently curved or contorted, sparingly branched, keeled, longitudinally wrinkled, and sometimes transversely wrinkled. They break with a short fracture. A section exhibits a horny translucent cortex free from starch grains, and a white, frequently irregularly developed, wood. The root has a distinctive odour; the taste is at first somewhat sweet, but afterwards acrid.

Chemistry.—The activity of senega, which resides in the cortical portion of the root, is due to the presence of an acid glucoside, *polygalic acid*, and a neutral glucoside, *senegin*; these are nearly allied to the similar products obtained from quillaya bark, and which form the active constituents of commercial

saponin. A volatile oil (containing methyl salicylate), pectin, resin, fixed oil and sugar (6 per cent.) are the less important constituents. Starch is absent.

Uses, etc.—Widely made use of as a stimulating expectorant and diuretic.

B.P. Preparations.

Infusum Senegæ - - 1 in 20.
Liquor Senegæ Concentratus, 1 in 2.
Tinctura Senegæ - - 1 in 5 of alcohol (60 per cent.)

B.P.C. Preparations.—Extractum Senegæ Liquidum, Infusum Senegæ Concentratum, Mistura Ammoniæ cum Senega, and Syrupus Senegæ.

Non-official Preparations.—Fluid Extract and Syrup (U.S.P).

Note.—Substitutions and Adulterations.

American Ginseng.—The root of Panax quinquefolium. (*N.O.* Araliaceæ. *Habitat.*—U.S.A.). Fusiform; from one and a half to three inches long; more yellow than senega from which it may also be distinguished by its greater freedom from wrinkles and twisting and the absence of a keel.

Common False Senega.—The root of Polygala Boykinii or P. alba. This closely resembles true senega, but is less twisted and has no keel; moreover, in cross-section it presents a circular woody column never, as in senega, incomplete. It is much less acrid than the true drug.

Swallow-wort.—Asclepias vincetoxicum. (*N.O.*—Asclepiadaceæ. *Habitat.*—Europe). The rhizomes of the plant are nearly cylindrical, and are interrupted at intervals of one half to one inch by tufts of pale-brown rootlets. There is an evident pith and abundance of starch.

Cypripedium.—The rhizomes of C. pubescens, *q.v.*, have been found substituted for senega root.

KRAMERIÆ RADIX.—Krameria Root.—

The dried root of (1) Para Rhatany, a species of Krameria, attributed to Krameria argentea, *Mart.* [*Fl. Brasil.* vol. xiii. pt. 3, plate 28]; or of (2) Peruvian Rhatany, Krameria triandra, *Ruiz and Pavon* [*Fl. Peruv.* vol. plate 93].

N.O.—Polygalaceæ.

Syn.—Rhatany Root; Radix Rhataniæ.

Habitats.—(1) Brazil; (2) Peru.

B.P. Characters.—(1) Para Rhatany occurs in cylindrical pieces, and is characterised by its purplish-brown colour and smooth thick bark, marked at intervals by deep transverse cracks, and adhering firmly to the wood, which is of a pale reddish-brown colour. Fracture short. (2) Peruvian Rhatany is characterised by its dark reddish-brown colour and its yellowish woody axis, from which the bark readily separates. The bark is thinner than that of Para Rhatany, bright reddish-brown internally, and rough and scaly except in the smaller pieces. Fracture splintery.

The barks of both kinds of Rhatany have a strongly astringent taste, and when chewed tinge the saliva red.

Chemistry.—A peculiar tannic acid called *ratanhia-tannic acid* (7 to 9 per cent.), which, by fusion with potassium hydrate, is

converted into *protocatechuic acid* [$C_6H_3(OH)_2COOH$] and *phloroglucin* [$C_6H_3(OH)_3$]. *Ratanhia-red* (the peculiar colouring matter) is produced by the oxidation of the tannin; wax, gum, and uncrystallizable sugar are also present in the root. The activity of rhatany root seems to reside in the cortical portion, the proportion of which is considerably greater in the Para than in the Peruvian variety. A strong tincture of these roots in brandy is used in Portugal to impart roughness to port wines. The constituents of the two official kinds of root are practically identical.

Uses, etc.—As an astringent; rarely given in the form of powder, of which the dose is 20 to 60 grains.

B.P. Preparations.

*Extractum Krameriæ -	aqueous, dry, yield 20 to 25 per cent.
Infusum Krameriæ - - -	1 part in 20.
Liquor Krameriæ Concentratus -	1 ,, 2 of alcohol (20 per cent.)
Pulvis Catechu Compositus -	1 ,, 5.
Tinctura Krameriæ - - -	1 ,, 5 of alcohol (60 per cent.)

**Contained in*

Trochiscus Krameriæ -	1 grain in each lozenge.
,, ,, et Cocainæ	,, ,, ,,

B.P.C. Preparations.—Extractum Krameriæ Liquidum, Infusum Krameriæ Concentratum, Syrupus Krameriæ.

Note.—Guayquil Rhatany.—Origin unknown; is large and woody; one half to one or two inches in diameter, and is strongly contorted. The cortical portion is brown and fibrous, and the surface warty.

Texas Rhatany, from KRAMERIA SECUNDIFLORA (K. lanceolata), has a root-stock about two inches thick, with a number of long, thin, branching roots having a thick blackish-brown spongy bark.

SAPONARIA.—Soapwort.—The dried root of Saponaria officinalis, *Linn.*

N.O.—Caryophyllaceæ.

Habitat.—Central and Southern Europe.

Characters.—About ten inches long, $\frac{1}{2}$-inch or more in thickness, nearly cylindrical, longitudinally wrinkled, light brown in colour, internally whitish, with a thick bark, containing numerous small white crystals and a pale yellow meditullium; inodorous; taste sweetish and bitter; persistently acrid.

Chemistry.—Saponin, a mixture of two glucosidal bodies *saporubrin* and *saporubric acid*, mucilage and a little resin. Saponin is split up by dilute acids into dextrose and *sapogenins*; its aqueous solution lathers like soap-water. There is also present in the epidermal cells of the leaves of this plant, a third glucoside, *saponarin* which yields a blue colour with iodine.

Uses, etc.—Comparable in its action with Senega or Sarsaparilla.

Note.—Levant Soapwort is GYPSOPHILA STRUTHIUM (*N.O.*—Caryophyllaceæ. *Habitat.*—South Europe); it is twelve inches long, about two inches thick, longitudinally and transversely wrinkled, pale-brownish externally, internally white, with hard wood, showing numerous medullary rays; its constituents are similar to those of the above.

ALTHÆÆ RADIX. - **Althæa Root.**—The root of Althæa officinalis, *Linn.*

N.O.—Malvaceæ.

Syn.—Marshmallow root.

Habitat.—Europe (and cultivated).

Characters.—The root is cylindrical, branched, three to six inches long, and about the thickness of the middle finger, plump, mucilaginous, white and fleshy internally; externally it is white, deeply wrinkled longitudinally, marked with a number of small, nearly circular scars, and somewhat hairy from the presence of loosened bast fibres; when not decorticated it is covered with a yellowish or brownish, somewhat corky outer layer. Odour faint and aromatic; taste sweetish and mucilaginous.

Chemistry.—Mucilage (35 per cent.), starch (35 per cent.), pectin, sugar, *asparagin* or *althein* (1 to 2 per cent.), cellulose, and a little fixed oil.

Note.—Asparagin is *amido-succinamic acid*, $C_2H_3NH_2,CONH_2,COOH$, or the monamide of *aspartic acid*, into which latter it may be converted by the action of alkalies and acids.

Uses, etc.—Much used for lozenge making on account of its mucilaginous nature. The *pâte de guimauve*, as usually sold, is a mixture of flour, gum, egg-albumen, sugar, etc. Marshmallow is included in the B.P.C. and U.S.P., and the flowers *(fleurs de guimauve)* in the French Codex. A syrup and decoction of marshmallow is included in the B.P. Codex.

Note.—Most malvaceous plants possess well-marked mucilaginous properties, and are employed for purposes where the latter are useful, in the localities where the plants are found. Characteristic of the order Malvaceæ is the monadelphous androecium.

TODDALIÆ RADIX.—**Toddalia.**—The root of Toddalea aculeata, *Pers.*

N.O.—Rutaceæ.

Syn.—Lopez root.

Habitat.—India and Ceylon.

Characters.—A solid heavy branching root, attaining some inches in diameter, having a suberous bitter cortical portion and yellow tasteless meditullium. Bark velvety, and of a dull yellow colour; taste bitter, pungent and aromatic.

Chemistry.—A little essential oil, little or no tannic acid, and much resin.

Uses, etc.—Official in the Indian Pharmacopœia as a stimulant tonic, and in the Indian and Colonial Addendum for use as a substitute for Cusparia bark.

CEANOTHUS.—**Red Root.**—The root of Ceanothus Americanus, *Linn.*

N.O.—Rhamnaceæ.

Syn.—New Jersey Tea.

Habitat.—North America.

Characters.—Head simple or branched, knotty-tuberculate; root twelve inches long and two-fifths to one inch thick, contorted, branched, brown, finely wrinkled; fracture granular; wood tough, pale brown-red with fine rays; inodorous; taste bitter and astringent.

Chemistry.—Tannin, starch, etc.

Uses, etc.—Astringent, tonic. *Dose.*—10 to 30 grains.

GLYCYRRHIZÆ RADIX.—Liquorice Root.—The peeled root and peeled subterranean stem of Glycyrrhiza glabra, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 74], and other species.

N.O.—Leguminosæ.

Syn.—Radix Liquiritiæ.

Habitat.—Europe and Western Asia (and cultivated).

B.P. Characters.—In long nearly cylindrical pieces; before being peeled, dark brown in colour and longitudinally wrinkled but not scaly; when peeled, yellow, with a nearly smooth fibrous surface. The fracture is coarsely fibrous. A transverse section exhibits a porous, distinctly radiate yellow wood, and a thick cortex, with groups of bast fibres arranged in radial lines. It has a faint odour and a characteristic sweet taste free from bitterness.

Chemistry.—*Glycyrrhizin* (3 per cent), resinous oil, *asparagin*, protein, gum, starch, etc. *Glycyrrhizin*, to which the drug owes its sweetness, is a mixture of the calcium and potassium salts of *glycyrrhizinic acid* ($C_{44}H_{64}O_{19}$); is soluble in water, alcohol, and alkalies, and is decomposed by acids with precipitation of the free acid. Glycyrrhizinic acid is decomposable into *glycyrrhetinic acid* and *glycuronic acid*. Being but slightly soluble in cold water, glycyrrhizin is present in but small quantity in the official extracts.

Note.—To obtain glycyrrhizinic acid an ammoniacal extract of the root (see footnote) is treated with sulphuric acid, and the precipitate purified by crystallization from 90 per cent. alcohol.

Uses, etc.—Licorice is demulcent, expectorant, and slightly laxative. The powdered root is useful in pill-making on account of its absorbent qualities.

B.P. Preparations.

*Extractum Glycyrrhizæ	made with cold water, yield 25 to 30 per cent.
†Extractum Glycyrrhizæ Liquidum	made with cold water; preserved by addition of spirit.
Liquor Sarsæ Compositus Concentratus	1 part in 10 of alcohol (about 20 per cent.).
Pilula Hydrargyri	1 part in 6.
Pulvis Glycyrrhizæ Compositus	1 „ 6.

**Contained in*
Confectio Sennæ, Decoctum Aloes Compositum.

†Contained in
Mistura Sennæ Composita, Tinctura Aloes.

B.P.C. Preparations.—Glycyrrhizinum, Ammoniatum, Mistura Glycyrrhizæ Comp. etc.

Note.—The decorticated root of G. GLABRA (Spanish or Italian) is alone admitted by the official description, the Russian wild variety from G. GLANDULIFERA occurs in large cylindrical pieces more fibrous and less compact in texture than the official variety and possessing a somewhat bitter taste. *Spanish Juice* (Solazzi) is prepared in Spain or

Italy, as is also the block extract of liquorice by boiling the fresh roots in water and evaporating to a suitable consistence. Pontefract or Pomfrey cakes are prepared in Yorkshire from English grown root.

The United States Pharmacopœia adopts the use of ammonia to ensure the extraction of the glycyrrhizin in preparing the extract and fluid extract, and together with the B.P.C. includes an ammoniated glycyrrhizin (*Glycyrrhizinum ammoniatum*), a scale preparation obtained by treating the root with ammonia water, precipitating the liquor with acid, dissolving the precipitated glycyrrhizinic acid in ammonia and drying the solution on glass plates.

ABRI RADIX.—Indian Liquorice.—The root of Abrus precatorius, *Linn.*

N.O.—Leguminosæ.

Syn.—Gunja, goontch.

Habitat.—India.

Characters.—Long and woody, about half an inch or less in diameter; externally pale reddish-brown; internally reddish. It has a thin bark, peculiar disagreeable odour, and a bitterish acrid flavour, leaving a faintly sweet after-taste.

Chemistry.—Contains sugar, *glycyrrhizin* and an acrid resin (8 per cent.).

Uses, etc.—Official in India; formerly believed to have demulcent properties, now known to be irritant and poisonous.

BAPTISIA.—Wild Indigo.—The root of Baptisia tinctoria, *Braun.*

N.O.—Leguminosæ.

Habitat.—United States of America.

Characters.—Consists of a knotty head, two or three inches broad, and below divided into branches, half an inch in diameter; of a dark-brown colour, slight peculiar odour, and a nauseous, bitter, somewhat acrid taste.

Chemistry.—*Baptisin* (a bitter glucoside), *baptin* (a glucoside, crystalline, soluble in water), *pseudo-baptisin* (glucoside), *baptitoxine* (a poisonous alkaloid), resin, starch, etc.

Uses, etc.—As emetic, stimulant and cathartic, usually given in decoction. *Dose.*—5 to 15 grains.

HEUCHERA.—Alum Root.—The root of Heuchera americana, *Linn.*

N.O.—Saxifragaceæ.

Habitat.—United States.

Characters.—About six inches long, half an inch thick, several-headed, somewhat contorted, branched, wrinkled, tuberculate, purplish-brown; internally reddish or brownish; bark thin; inodorous; highly astringent and bitter.

Chemistry.—18 to 20 per cent. of tannin.

Uses, etc.—As an astringent. *Dose.*—15 to 30 grains.

HYDRANGEA.—Hydrangea.—The root of Hydrangea arborescens, *Linn.*

N.O.—Saxifragaceæ.

Habitat.—United States of America.

Characters.—Head irregular, knotty; roots of variable length and thickness, bent and branched; externally pale-grey; tough; fracture

splintery; internally white; bark thin and readily separated from the wood; inodorous; taste sweetish and somewhat pungent.

Chemistry.—Resin, gum, sugar, starch and a glucoside, *hydrangin*.

Uses, etc.—Diuretic. *Dose.*—30 to 60 grains in powder.

BRYONIÆ RADIX.—Bryony Root.—The root of Bryonia alba, *Linn.* (black-berried Bryony) and B. dioica, *Linn.* (red-berried Bryony), collected in the spring.

N.O.—Cucurbitaceæ.

Syn.—Mandrake.

Habitat.—Central and Southern Europe.

Characters.—From eighteen inches to two feet long, and two to four inches thick; in the fresh state, fleshy. Internally white, with a thin bark, brown cambium line, broad medullary rays, and numerous wood bundles, arranged in radiating lines. Usually found in commerce in dried discs with a triangular radiating and concentric arrangement of the wood. The dried root is inodorous and has a bitter taste.

Chemistry.—*Bryonin* (a bitter glucoside or mixture of glucosides), *bryoresin*, starch, gum, sugar, etc.

Uses, etc.—Applied externally in the fresh state, the root has a vesicant action; internally it acts as a cathartic. A tincture *(B.P.C.)* is prepared (1 in 10) from spirit of such a strength as to produce with the moisture of the fresh root a menstruum of 60 per cent. strength.

Note.—The Brazilian *Taynya root* is said to be derived from a species of Bryonia. The so-called *black Bryony* is derived from TAMUS COMMUNIS. (*N.O.*—Dioscoreaceæ.) It is a large fleshy root, sometimes used in its fresh state as an external application to bruises. Taken internally it is diuretic and emetic.

SUMBUL RADIX.—Sumbul Root.—The dried transverse slices of the root of Ferula Sumbul, *Hook, f.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 129].

N.O.—Umbelliferæ.

Syn.—Jatamansi, Musk Root.

Habitat.—Russia, India, Turkestan.

B.P. Characters.—Varying much in size, but usually from about one inch to three inches (two and a half to seven and a half centimetres) in diameter, and from three quarters of an inch to an inch (eighteen to twenty-five millimetres) or more in thickness. The pieces are covered on the outer surface with a dusky-brown, papery, transversely wrinkled cork, and are sometimes beset with short bristly fibres; internally they are spongy, coarsely fibrous, dry and dirty yellowish-brown, mottled with whitish patches and spots of exuded resin. Odour strong, musk-like; taste bitter, aromatic.

Chemistry.—*Volatile oil* (0·3 per cent.); resin (6 per cent.), of a musk-like odour; *angelic* (C_4H_7COOH) and *valeric* acids; by dry distillation gives *umbelliferone* ($C_6H_3O.OH.CH.CH.CO.$), which is yielded by many resins of the N.O. Umbelliferæ.

Uses, etc.—As a stimulant and antispasmodic, resembling Valerian in its action.

B.P. Preparation.

Tinctura Sumbul - 1 in 10 of alcohol (70 per cent.)

Non-official Preparations.—Extract and Fluid Extract U.S.P.

Note.—It has been pointed out that the Sumbul root of commerce to-day differs from the original drug and is probably derived from a different species of Ferula than that officially given. *False Sumbul* is the root of DOREMA AMMONIACUM; it is of closer texture, denser, and more firm, of a reddish or yellowish tint and feeble odour.

ANGELICA.—Angelica Root.—The root of Angelica Archangelica, *Linn.*

N.O.—Umbelliferæ.

Syn.—Garden angelica.

Habitat.—Most places in the northern parts of Europe.

Characters.—Wrinkled, two to four inches long and one inch or more in diameter, and beset with long descending radicles; greyish-brown externally, white and spongy internally; fracture starchy, exhibiting resinous spots; taste warm and bitterish; odour strong and fragrant; taste sweetish, pungent and bitter.

Chemistry.—Volatile oil (1 per cent.), resin, valeric acid, *angelic acid* (C_4H_7COOH), *angelicin* an acid resin, sugar, bitter principle, etc.

Uses, etc.—Formerly much used as a specific for typhoid; has tonic, stimulant and diaphoretic properties, etc. *Dose.*—10 to 30 grains in powder.

Note.—ANGELICA ATROPURPUREA, *Linn.* (*American Angelica*) has a root similar in appearance to the above, and with nearly allied constitution and properties.

PETROSELINUM.—Parsley.—The root of Petroselinum sativum, *Hoffm.*

N.O.—Umbelliferæ.

Habitat.—South Europe (and cultivated).

Characters.—Conical, about six inches long and about half an inch thick; light brown-yellow; annulate above, wrinkled below with transverse ridges; faintly aromatic, sweetish; fracture short; bark thick, resinous, dotted and like the medullary rays, white; wood light yellow, porous.

Chemistry.—Starch, mucilage, sugar, volatile oil, and *apiin* ($C_{24}H_{28}O_{13}$). The latter is white, inodorous, tasteless and soluble in boiling water.

Uses, etc.—As a carminative, tonic and diuretic. *Dose.*—½ to 1 drachm in infusion.

IMPERATORIA.—Masterwort.—The root of Imperatoria ostruthium, *Linn.*

N.O.—Umbelliferæ.

Habitat.—South and Central Europe.

Characters.—Somewhat conical, about two inches long and nearly four-fifths inch thick, flattish, finely annulate above, wrinkled and tuberculate; brown-grey, internally whitish with numerous resin dots; odour balsamic; taste pungent and bitter; bark thin, wood-bundles small, enclosing a large pith.

Chemistry.—Volatile oil, *imperatorin* (peucedanin), *ostruthin*. Imperatorin is crystalline, pungently acrid and insoluble in water.

Uses, etc.—Has stimulant and tonic properties but is now little used. *Dose.*—15 to 30 grains.

UMBELLIFERÆ.

Other less important drugs of the order Umbelliferæ are the roots of—

LEVISTICUM OFFICINALIS, *Koch.* (*Lovage*), head two to four inches long and one to one and half inches thick; divided below into a few sub-cylindrical branches; brown or red-brown; fracture short, spongy; aromatic, sweetish, pungent and bitter. Lovage contains volatile oil, angelic acid, bitter extractive, resins, etc.

LASERPTIUM LATIFOLIUM, *Linn.* (*White Gentian*), several-headed, somewhat conical, annulate above, branched below, deeply wrinkled; brown corky layer removed; greyish-white, aromatic, bitter; fracture short, white; bark thick, with numerous orange-coloured resin-ducts; wood finely porous; contains volatile oil and bitter principle.

PIMPINELLA SAXIFRAGA, *Linn.* (*Pimpernel*), several-headed, branches of the head short, terminated by the hollow stem base; fusiform, about eight inches long, annulate above, tuberculate below; externally yellowish-brown; aromatic, sweetish, pungent; bark thick, radiate; wood yellowish, porous radiate; contains volatile oil, acid resin and *pimpinellin*.

SANICULA MARILANDICA, *Linn.* (*sanicle, black snake-root, pool root*) contains resin and volatile oil, and has been used with alleged success in intermittent fever and in chorea. *Dose.*—10 to 60 grains.

IPECACUANHÆ RADIX.—Ipecacuanha Root.

—The dried root of Psychotria (Cephaëlis) Ipecacuanha, *Stokes* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 145—the long-styled form. *Berg. und Schmidt, Off. Gewächse*, vol. ii. tab. xv^{c}.—the short-styled form].

N.O.—Rubiaceæ.

Syn.—Ipecac., "Rio" Ipecac.

Habitat.—Brazil.

B.P. Characters.—Ipecacuanha occurs in somewhat tortuous pieces not often exceeding six inches (fifteen centimetres) in length, and one quarter of an inch (six millimetres) in thickness. It varies in colour from dark brick-red to very dark brown, and is closely annulated externally, the annulations not taking the form of narrow merging ridges (distinction from Carthagena ipecacuanha). It breaks with a short fracture, the fractured surface exhibiting a thick greyish cortex, which usually has a resinous but somewhat starchy appearance, and a small dense central portion. When examined under the microscope the cortex exhibits small compound starch grains and raphides; the wood contains no vessels. The odour is slight, the taste bitter.

Chemistry.—Alkaloid (1·6 to 2·8 per cent.), in combination with *cephaëlic* or *ipecacuanhic acid*, and consisting of *emetine*, *cephaëline* and *psychotrine*. Emetine, or methyl-cephaëline ($C_{15}H_{21}NO_2$), constitutes nearly three-fourths of the total

alkaloids; is amorphous and white when pure and fresh, but becomes yellowish. It is soluble in chloroform, ether, spirit, glycerine, and acetic acid; sparingly in water. By the action of solution of chlorinated lime its solution in acetic acid assumes a permanent yellow colour. It resides chiefly in the cortical portion, which forms 80 to 90 per cent. of good roots. Cephaëline ($C_{14}H_{20}NO_2$) is crystalline, and little soluble in ether. It is said to differ in therapeutic value from emetine, being more strongly emetic, but of less expectorant power. Resin, fat, protein, fermentable and crystallizable sugar, and a large quantity of pectin, starch, and lignin are also present. Commercial emetine is often a mixture of emetine and cephaëline.

Uses, etc.—Ipecacuanha is widely used as an expectorant and emetic. Under the title of "de-emetinized ipecac." the root, deprived of its alkaloidal substance, has been recommended for, and has been used in, chronic dysentery.

B.P. Preparations.

*Extractum Ipecacuanhæ Liquidum - - containing 2·00 to 2·25 per cent. total alkaloids [about 1 part in 1].
†Pulvis Ipecacuanhæ Compositus - - 1 part in 10.
Trochiscus Ipecacuanhæ - - - containing $\frac{1}{4}$ grain in each lozenge.
,, ,, et Morphinæ - containing $\frac{1}{12}$ grain in each.

**Used in the preparation of*
Acetum Ipecacuanhæ - - - 1 part in 20.
Vinum ,, - - - 1 ,, 20.

†*Contained in*
Pilula Ipecacuanhæ cum Scilla - - 1 ,, 2, about.

B.P.C. Preparations.—Pulvis Ipecacuanhæ de-emetinisatus, Cephaelina, Emetina, Extractum Ipecacuanhæ Miscibile, etc.

Dose.—As an expectorant, $\frac{1}{4}$ to 2 grains; as an emetic, 15 to 30 grains.

Note 1.—Liquid extract of Ipecacuanha is a standardized preparation, the B.P. giving a method of assay for total alkaloids in which their solubility in chloroform is made use of.

Note 2.—Collection, etc.—Ipecacuanha plants are small and shrubby, and grow in clusters. The collection, which goes on all the year round, is carried on by "poayeros," who grasp the cluster with one hand and beat it with a stick with the other. A part of the root is left in the ground, from which another plant springs up. The petiole of a leaf is also capable of producing roots and buds. The gathered roots are dried in the sun and their colour varies, being variously red, grey, brown, or blackish.

Note 3.—Substitutions and Adulterations.—The *stems* of the official plant are frequently found to constitute as much as 30 per cent. of the drug when imported. Though of no official value, they contain from 1 to 1½ per cent. of alkaloid.

Carthagena Ipecacuanha—the root of Cephaelis (Psychotria) acuminata is larger or fatter than the official drug, is much less annulated, has a more resinous, very thick cortex and more evident medullary rays. It contains from $\frac{1}{6}$ to 2 per cent. of alkaloid which consists in about 60 per cent. of cephaëline. This root together with the "Rio" variety is official in the U.S.P. which requires not less than 2 per cent. of ipecac alkaloids.

Striated or Black Ipecacuanha—the root of PSYCHOTRIA EMETICA (*N.O.*—Rubiaceæ. *Habitat.*—Brazil) is distinguished by having longitudinal striæ and transverse constrictions at intervals (not annulations), resembling a string of sausages. The cortical portion is dark-coloured, especially on the addition of a little water; it remains soft and moist and tough to the knife, even after many years; does not contain starch, and its essential constituent is emetine, which is present in but small quantity.

Undulated or Wavy Ipecacuanha—the root of RICHARDSONIA SCABRA. (*N.O.*—Rubiaceæ. *Habitat.*—Brazil)). The root is undulated or wavy, and, when broken, dust (starch) falls out; it has a whitish, very thick and brittle cortical portion.

Ionidium or White Ipecacuanha—the root of IONIDIUM IPECACUANHA (*N.O.* Violaceæ. *Habitat.*—Brazil). From two to four inches long, having at the base a knotty crown from which arise numerous aerial stems; below, twisted and branched; diameter one-sixteenth to three-eighths of an inch; cortical portion thin, wrinkled and shrivelled longitudinally, and of a light greyish colour; meditullium lighter; fracture short and brittle; little odour and taste; contains neither starch nor alkaloid.

East Indian Ipecacuanha the monocotyledonous root of probably CRYPTOCORYNE SPIRALIS (*N.O.*—Aroideæ), is distinguished from the true drug by the arrangement of its vascular bundles (monocotyledonous), as seen in cross section. It contains no alkaloid.

RUBIA.—Madder.—The root of Rubia tinctorum, *Linn.*

N.O.—Rubiaceæ.

Habitat.—Levant and South Europe.

Characters.—Rhizome cylindrical, long, one-fifth of an inch thick, with distant nodes; roots about one-eighth of an inch thick, dark red, deeply wrinkled with foliaceous cork; thin brown inner bark, spongy red wood and irregular medullary rays; fracture short; taste sweetish, acrid, astringent; odour feeble. Usually found in the form of powder.

Chemistry.—*Rubian, rubhydran, ruberythric acid, alizarin,* purpurin, sugar, tannin, etc.

ALIZARIN ($C_{14}H_8O_4$) is the most important derivative of the root, and until this was synthetically produced from anthracene, madder was extensively used for dyeing purposes. Alizarin is an orange-red, crystalline, sublimable body, soluble in boiling water, alcohol and ether. It is formed by the decomposition of ruberythric acid which is present in fresh madder, and is hence found in the dried root. Chemically it is dihydroxyanthraquinone $C_{14}H_6(O_2)(OH)_2$. It may be prepared synthetically by (1) heating *phthalic anhydride* with phenols, *e.g.*, with *pyrocatechin* $C_6H_4(CO)_2O+C_6H_4(OH)_2$ $C_6H_4(CO)_2C_6H_2(OH)_2$, and (2) by fusing *anthraquinone sulphonic acid* with caustic potash. Being a *diphenol* alizarin behaves as an acid and gives a purple red colour in alkaline solution.

Uses, etc.—As a dye; rarely as a medicine.

CAHINCA.—Cahinca Root.—The root of Chiococca racemosa, *Jacq.*

N.O.—Rubiaceæ.

Syn.—Radix cainanæ.

Habitat.—South America and West Indies.

Characters.—Woody, three to six inches long, about one-twelfth to one-quarter inch thick, more or less bent, externally blackish or greyish-brown, finely wrinkled longitudinally with narrow, transverse, corky ridges and with a fine brown bark of resinous lustre internally, and a whitish wood. Taste of bark nauseous, bitter and acrid.

Chemistry.—Tannin and *cahincin,* which is white, crystalline, soluble in 600 parts of cold water.

Uses, etc.—Tonic and diuretic, now little used. *Dose.*—15 to 20 grains.

TARAXACI RADIX.—Taraxacum Root.—

The fresh and dried roots of Taraxacum officinale, *Wiggers* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 159]. Collected in the autumn.

N.O.—Compositæ.

Syns.—Dandelion Root; Leontodon Taraxacum.

Habitat.—Britain.

B.P. Characters.—Root, when fresh, frequently a foot (three decimetres) or more in length, and half an inch (twelve millimetres or more in diameter, smooth and yellowish-brown externally, whitish within. It breaks readily with a short fracture; from the fractured surface, which exhibits fair concentric rings, a milky juice exudes. When dried, it is more or less shrivelled, deeply wrinkled longitudinally, dark brown or nearly black, breaks with a short fracture, and the exposed surface shows a small yellow porous wood, surrounded by a thick nearly white cortex which exhibits a variable number, according to its size, of irregular well-marked concentric rings, Inodorous; taste bitter.

Chemistry.—*Taraxacin* (crystalline bitter), an acrid resin, *taraxacerin* and mannite. The dried autumn-collected root contains much inulin (24 per cent.), this substance replacing the lævulin and uncrystallizable sugar present in spring and summer.

Uses, etc.—Diuretic and feeble hepatic tonic.

B.P. Preparations.

Extractum Taraxaci - from juice expressed from fresh root; yield, in autumn, about 10 per cent.
Extractum Taraxaci Liquidum, made from dried root.
Succus Taraxaci - expressed from fresh root.

B.P.C. Preparations.—Decoctum Taraxaci and Elixir Taraxaci Compositum.

Note.—"Any adherent leaves are runcinate and quite smooth."—B.P. 1867. This description was intended to distinguish the official plant from another species of the same genus, viz., Leontodon hispidus (Aspargia hispida), *hawkbit*. There is a difference of opinion as to the best time for collecting Dandelion roots. The yield of taraxacin is greater in spring, while the yield of inulin and other inert matters is greater in autumn. Since the activity of this plant is due to taraxacin it would seem right to collect when this happens to be present in greatest quantity, and it is generally agreed that it should never be gathered during frosty weather. On account of the variability of the constituents of the plant, according to the time of the year when it is gathered, the yield and composition of the official extract are very variable. If it be prepared from roots collected in autumn, the resulting product yields a turbid solution with water; if, from spring-collected roots, the aqueous solution will be clear, and yield but very little sediment on standing, because of the conversion of the inulin into lævulose at this active period of the plant's life.

Substitutions.—*Hawkbit root* and *Chicory root*. The latter is of a paler colour, more bitter, and has the laticiferous vessels in radiating lines.

PYRETHRI RADIX.—Pyrethrum Root.—The dried root of Anacyclus Pyrethrum, *DC.* [*Bent. and Trim. Med. Pl.* vol. iii. plate 151].

N.O.—Compositæ.

Syns.—Pellitory Root; Roman pellitory.

Habitat.—South of Europe and North Africa.

B.P. Characters.—In unbranched pieces, usually varying from two to four inches (five to ten centimetres) in length, and half an inch (twelve millimetres) or more in thickness; nearly cylindrical, or frequently tapering towards both extremities, the crown often bearing a tuft of nearly colourless hairs. The outer surface is brown and longitudinally wrinkled. The fracture is short; the fractured surface shows the wood to be traversed by large medullary rays in which, as in the cortex, numerous dark resin-ducts are scattered. The root has a distinct characteristic odour and pungent taste, exciting, when chewed, a copious flow of saliva.

Chemistry.—The activity of the root is said to be due to a crystalline alkaloid for which the names *pellitorine* and *pyrethrine* have been suggested. Pyrethrine yields *pyrethric acid* when decomposed, and dissolves in strong sulphuric acid, with a yellow colour changing to red. There are also present an acrid resin and two acrid fixed oils with considerable inulin, gum and tannic acid.

B.P. Preparation.

Tinctura Pyrethri - 1 part in 5 of alcohol (70 per cent.)

Note.—German Pellitory is the root of ANACYCLUS OFFICINARUM, a plant indigenous to Africa and cultivated in Germany. It is about half the thickness of the official root, and has often the remains of leaves and stalks attached. In pungency it is equal to the official drug.

ADULTERATIONS AND SUBSTITUTIONS.—Dandelion root looks a little like pellitory root, but close examination will show a difference in the internal structure, the former having a yellowish meditullium bordered by concentric brown rings, while the latter has a radiate structure.

CICHORII RADIX.—Wild Chicory.—The root of Cichorium Intybus, *Linn.*

N.O.—Compositæ.

Syn.—Succory.

Habitat.—Europe.

Characters.—When wild, woody; when cultivated, fleshy, and with a thicker cortex. It is several headed, ten to twelve inches long, branched, longitudinally wrinkled, light brown externally, whitish internally. The cortical portion somewhat thin, white, radially striate, from the dark-coloured laticiferous vessels, and separated by a brown cambium line from the finely porous yellow wood, marked by fine medullary rays, and one or more annual rings. Inodorous, and of a mucilaginous and bitter taste.

Chemistry.—Bitter principle, inulin, sugar, etc.

Uses, etc.—Has properties similar to those of Dandelion.

Note.—When dried, roasted, and coarsely powdered, chicory root is used as a substitute for, and an adulterant of, ground coffee. It differs from coffee in the absence of volatile oil, rich aromatic flavour, caffeine and caffeo-tannic acid, and presence of a large amount of ash, including silica. In the roasted condition it is found to contain the following constituents:—Gum (9 to 14 per cent.), glucose (10 to 11 per cent.), caramel (20 to 30 per cent.), fatty matter (2 to 5 per cent., from lard used in the roasting process), burnt woody matter (28 per cent.), ash (4 to 7 per cent.), moisture (12 to 14 per cent.), and it yields 45 to 65 per cent. of soluble extractive matter. Roasted coffee yields but 21 to 25 per cent. water soluble extractive, this difference affording a means of approximately determining the proportion of chicory in a mixture.

INULÆ RADIX.—Elecampane Root.—The dried root of Inula Helenium, *Linn.*

N.O.—Compositæ.

Syn.—Radix Helenii.

Habitat.—Central and Southern Europe (and cultivated).

Characters.—In transverse, concave slices or longitudinal sections, with overlapping bark, externally wrinkled and brown, flexible in damp weather; when dry, breaking with a short fracture; internally greyish, fleshy, slightly radiate, and dotted with numerous shining, yellowish-brown resin cells; odour peculiar, violet-like, aromatic; taste bitter and pungent.

Chemistry—Concrete volatile oil (consisting of *alanto-lactone* $C_{14}H_{20}OCO$, *alantol, alantolic acid* and *helenin*), acrid resin, a bitter principle, wax, and *inulin* (44 per cent. in autumn roots).

INULIN ($6C_6H_{10}O_5,H_2O$) is a starch-like compound, and apparently the anhydride of lævulose; it is a frequent constituent of composite plants, where it may be regarded as replacing the starch present in other roots. It is soluble in hot water, but, unlike starch, does not gelatinize, and gives no blue colour with iodine.

Uses, etc.—Formerly official in the U.S.P. A favourite domestic remedy for bronchitis, etc. *Dose.*—$\frac{1}{4}$ to 2 dr.

Note.—INULA SQUARROSA and I. DYSENTERICA (Pulicaria dysenterica) (*fleawort*) are used in domestic medicine in S. Europe.

LAPPA.—Burdock. The root of Arctium Lappa, *Linn.* (Lappa officinalis).

N.O.—Compositæ.

Syn.—Radix Bardanæ.

Habitat.—Britain and other parts of Europe.

Characters.—About twelve inches or more long, and about one inch thick; nearly simple, fusiform, fleshy, longitudinally wrinkled, crowned with a tuft of whitish, soft, hairy leaf-stalks; grey-brown, internally paler; bark somewhat thick, the inner part and the soft wood radially striate, the parenchyma often with cavities, lined with snow-white remains of tissue; odour feeble and unpleasant; taste mucilaginous, sweetish, and somewhat bitter.

Chemistry.—*Inulin*, mucilage, sugar, a bitter glucoside *Lappin*, a little resin, and some tannic acid.

Uses, etc.—Burdock was formerly much used as a popular remedy; it is now more or less obsolete. Its action is said to be diaphoretic, alterative and diuretic. *Dose.*—30 to 120 grains in decoction. From it are prepared—Extractum Bardanæ (aqueous) and Fluidextractum Lappæ, U.S.P.

ARTEMISIÆ RADIX. -Mugwort Root.—The root of Artemisia vulgaris, *Linn.*

N.O.—Compositæ.

Habitat.—Asia, Europe and Africa.

Characters.—About eight inches in length, woody, beset with numerous thin and tough radicles; radicles two or four inches long and about one-twelfth inch thick; light brown externally; internally whitish; with an angular wood and thick bark showing five or six resin cells; taste sweetish acrid.

Chemistry.—Volatile oil, acrid resin and tannin.

Uses, etc.—At one time much used as a remedy for epilepsy; has stimulant and tonic properties. *Dose.*—15 to 60 grains in infusion.

STATICE.—Marsh Rosemary.—The root of Statice Limonium, *Gray, var.* caroliniana.

N.O.—Plumbaginaceæ.

Syn.—Ink root, sea lavender.

Habitat.—Europe and America.

Characters.—Several headed, one to two feet long and one or more inches thick; closely annulate above; branches longitudinally wrinkled; root purplish-brown externally, paler internally; breaks with short fracture, showing thick bark and meditullium with narrow pale-yellow wood-edges; odourless; taste astringent and slightly bitter.

Chemistry.—14 to 18 per cent. of tannin.

Uses, etc.—As an astringent. *Dose.*—8 to 30 grains.

Note.—Bayacura used in Brazil is the root of STATICE BRASILIENSIS; it contains tannin and also, it is said, a crystalline alkaloid *baycurine*. Other species of Statice are used for their astringent properties in the various countries in which they are indigenous.

APOCYNUM.—Canadian Hemp.—The root of Apocynum cannabinum, *Linn.*, or of closely allied species of Apocynum.

N.O.—Apocynaceæ.

Habitat.—Canada and United States.

Characters.—Long, cylindrical, somewhat branched, a quarter to one-third of an inch thick, pale brown, longitudinally wrinkled, and transversely fissured; brittle; fracture short, white; the bark thick; the wood porous, spongy, with delicate medullary rays and a thin pith; inodorous; taste bitter and disagreeable.

Chemistry.—The bitter glucosides, *apocynin* and *apocynein*, extractive, tannic and gallic acids, etc.

Uses, etc.—A powerful emetic and cathartic; official in the U.S.P. where it is used for making a fluid extract. *Dose* (as an emetic)—15 to 30 grains.

The *B.P.C.* includes a tincture and liquid extract.

Note.—Dog's-bane, APOCYNUM ANDROSÆMIFOLIUM, is very similar in appearance to the above, for which it has been not infrequently substituted; its active principles are said to be practically identical with those of Apocynum cannabinum.

HEMIDESMI RADIX.—Hemidesmus Root.

The dried root of Hemidesmus indicus, *R. Br.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 174].

N.O.—Asclepiadaceæ.

Syn.—Indian Sarsaparilla.

Habitat.—India.

B.P. Characters.—The root is long, rigid, nearly cylindrical, tortuous, and longitudinally furrowed. It seldom exceeds one quarter of an inch (six millimetres) in thickness, and is of a reddish-brown or dark-brown colour. On one side of the root the cork is frequently separated from and raised above the cortex, and is transversely fissured. The transverse section exhibits numerous laticiferous cells in the cortex. The root has a fragrant odour and a somewhat sweet taste.

Chemistry.—Coumarin, starch, and in the suberous layer, tannic acid.

Uses, etc.—Though said to have medicinal value, its chief use is as a flavouring agent.

B.P. Preparation.

Syrupus Hemidesmi - - - 1 part in 8, nearly.

ASCLEPIAS—Pleurisy Root.—The root of Asclepias tuberosa, *Linn.*

N.O.—Asclepiadaceæ.

Habitat.—United States of America.

Characters.—Large and fusiform, dried in longitudinal and transverse sections, from one to six inches long, and about three quarters of an inch, or more in thickness; the head knotty and slightly, but distinctly annulate; the remainder longitudinally wrinkled; externally orange-brown, internally whitish; tough, and having an uneven fracture; bark thin, and in two distinct layers, the inner one whitish; wood yellowish, with large, white medullary rays; inodorous, and having a bitterish, somewhat acrid taste. When long kept it acquires a grey colour.

Chemistry.—A glucosidal principle, *asclepiadin*, having the taste of the root and precipitated by tannic acid; starch, gum, etc.

Uses, etc.—Sudorific and expectorant. *Dose.*—15 to 60 grains. Formerly official in the U.S.P. for the preparation of a fluid extract.

Note.—The roots of ASCLEPIAS INCARNATA, A. SYRIACA (*common milk weed*), A. CURASSAVICA, all indigenous to the Continent of America, have properties similar to the above.

GENTIANÆ RADIX.—Gentian Root.—The dried rhizome and roots of Gentiana lutea, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 182].

N.O.—Gentianaceæ.

Habitat.—Central and Southern Europe.

B.P. Characters.—In nearly cylindrical pieces, entire or longitudinally split, varying in length, but seldom exceeding

an inch (two and a half centimetres) in thickness, yellowish-brown externally, and longitudinally wrinkled. The rhizome bears in addition closely approximated encircling leaf scars, and is frequently terminated by a bud. Gentian Root is tough when slightly moist, but brittle when dried. The fractured surface is of a nearly uniform reddish-yellow colour. The central portion consists principally of parenchymatous tissue, is soft and is not distinctly radiate. Gentian Root should not yield any definite reactions with the tests for starch. The odour is characteristic; the taste is at first slightly sweet but afterwards bitter.

Chemistry.—Uncrystallizable sugar (*gentianose*, 12 per cent.), much pectin, a little volatile oil and fat. The active principles are the glucosides *gentiopicrin*, *gentiamarin* and *gentiin*; there is also present *gentisin* (*gentianic* or *gentisic acid*), inert, giving yellow colour with alkalies. Alcohol extracts its virtues completely.

Uses, etc.—One of the most widely used tonic-bitters. The Swiss and Tyrolese manufacture from it a "gentian brandy," which is much prized by them as a stomachic and pick-me-up.

B.P. Preparations.

Extractum Gentianæ, aqueous; yield, about 50 per cent.			
Infusum	„	Compositum - -	1 part in 80.
Tinctura	„	Composita - -	1 „ 10 of alcohol (45 per cent.)

B.P.C. Preparations.—Infusum Gentianæ Compositum Concentratum, Mistura Gentianæ, Mistura Gentianæ Acida, Mistura Gentianæ et Soda, Tinctura Gentianæ.

Note.—GENTIANA PURPUREA, G. PANNONICA, G. PUNCTATA are European gentians having similar medicinal properties to the above, and are used indiscriminately with each other and with the official roots, from which they differ but little in appearance. *American Gentian root* is derived from G. PUBERULA, G. SAPONARIA, G. ANDREWSII. This drug also is said to have properties practically identical with those of the European varieties. Belladonna and aconite roots, and the rhizomes of orris and white hellebore, have been found mixed with genuine root.

FRASERA.—American Columbo.—The root of Frasera Walteri, *Michaux*.

N.O.—Gentianaceæ.

Habitat.—United States.

Characters.—In longitudinal slices, about one inch in thickness, the upper portion annulate, the lower longitudinally wrinkled, externally pale orange-brown, internally light yellowish-brown; bark thick; odour gentian-like; taste sweetish and bitter.

Chemistry.—*Gentiopicrin*, an active principle of Gentian root, is present but in a smaller quantity than in the latter.

Uses, etc.—Much the same as Gentian. *Dose.*—15 to 30 grains.

ALKANNÆ RADIX.—Alkanet Root.—The dried root of Alkanna (Anchusa) tinctoria (*Linn.*), *Tausch.*

N.O.—Boraginaceæ.

Syn.—Orcanette.

Habitat.—South of Europe.

Characters.—In pieces, three to four inches long, from the thickness of a quill to that of the little finger, often retaining remnants of hairy leaves; somewhat twisted, consisting of a dark red, easily separable bark and an internal ligneous portion which is reddish externally, and whitish near the centre, and composed of numerous distinct, slender, cohering fibres. Odour faint; taste bitterish and astringent.

Chemistry.—*Alkannin* (*anchusin* or *anchusic acid*), 5 per cent., the colouring principle, resides in the cortical portion, and is soluble in alcohol, ether, petroleum-benzine and oils, but insoluble in water; with alkalies it becomes blue.

Uses, etc.—Chiefly for colouring oils and pomades.

Note.—The roots of Onosma echioides and of Macrotamia cephalotes are larger than alkanet, but contain a similar colouring matter in less proportion.

SYMPHYTUM.—Comfrey.—The root of Symphytum officinale,

N.O.—Boraginaceæ.

Habitat.—Europe; cultivated in the United States.

Characters.—Spindle-shaped, branched, one inch or less in diameter and up to a foot long, externally smooth and blackish, internally white, fleshy and juicy. When dry, wrinkled, of a firm, horny consistence, and of a dark colour inside. Inodorous, and of a mucilaginous taste.

Chemistry.—Mucilage (the most important constituent), tannin, and a trace of starch.

Uses, etc.—An old-fashioned domestic cough remedy. *Dose.*—10 to 15 grains.

SCAMMONIÆ RADIX.—Scammony Root.—The dried root of Convolvulus Scammonia, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 187].

N.O.—Convolvulaceæ.

Habitat.—Syria and Asia Minor.

B.P. Characters.—Brownish-grey or yellowish grey, tapering or nearly cylindrical roots, varying usually from one to three inches (two and a half to seven and a half centimetres) or more in diameter. The root is frequently contorted and the surface longitudinally furrowed. It is enlarged at the crown, and bears the remains of slender aerial stems. The fracture is very coarsely fibrous; internally the colour is light or dark grey. The section exhibits an abnormal wood, consisting of numerous irregularly arranged wood bundles; and, when examined under the microscope, appears beset with starch grains of characteristic shape, and especially in the cortical region, with resin-cells. Odour characteristic; taste at first somewhat sweet,

afterwards slightly acrid. It yields to *alcohol* (90 per cent.) a resin which should have the properties of Scammony Resin.

Chemistry.—Contains the glucosidal resin *scammonin* (4 to 8 per cent.), gum (5 to 8 per cent.), sugar and starch.

Uses, etc.—For the preparation of Scammony Resin.

B.P. Preparation.

Scammoniæ Resina.

Note.—Mexican Scammony or Male Jalap is the root of *Ipomœa orizabensis* and is readily distinguished from the official root, it occurs usually in transversely cut pieces showing a concentric structure with protruding fibres.

SCAMMONY RESIN is obtained by making a tincture of the root and precipitating the resin from solution by the addition of water; the precipitated resin is washed with hot water and dried at 100° C. By this means it is obtained in brownish translucent pieces, brittle, resinous in fracture, and of a fragrant odour. It cannot, alone, form an emulsion with water (thus differing from scammony). Its spirituous tincture does not strike a blue colour when applied to the fresh cut surface of a raw potato (near to the "eye"), nor does it in alcoholic solution give a blue colour with solution of ferric chloride or with solution of hydrogen peroxide, indicating absence of guaiacum resin. Ether should dissolve it entirely (absence of jalap resin), but in commercial samples a little remains undissolved, varying from 0·2 to 1·0 per cent., this being resin altered by the heat used in evaporating the spirit in its preparation. The resin consists of *scammonin* ($C_{34}H_{56}O_{16}$), with a small quantity of colouring matter. Scammonin is identical with *jalapin* (*orizabin*), the purgative principle of male jalap, and is of a glucosidal character.

Uses, etc.—A purgative, usually given in conjunction with other medicine. *Dose.*—3 to 8 grains.

B.P. Preparations of Scammony Resin.

Extractum Colocynthidis Compositum	-	1	part in	7,	nearly.
Pilula Colocynthidis Composita	-	1	,,	3,	,,
,, Scammonii Composita	-	1	,,	3,	,,
Pulvis Scammonii Compositus	-	1	,,	2,	,,

B.P.C. Preparations.—Confectio Scammonii, Pulvis Scammonii c. Hydrargyro, Tabletta Colocynthidis Composita.

JALAPA.—Jalap.

—The dried tubercules of Ipomœa Purga, *Hayne* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 186].

N.O.—Convolvulaceæ.

Habitat.—Mexico.

B.P. Characters and Test.—Dark brown, irregularly oblong, ovoid, napiform or fusiform roots, varying in length from one to three inches (two and a half to seven and a half centimetres) or more, the larger being frequently incised. They are hard, compact, and heavy. Externally they are furrowed and wrinkled, and marked with small transverse scars; internally they vary in colour from yellowish grey to dingy brown. The transverse section usually exhibits irregular dark concentric lines, and, when examined under the microscope, numerous compound starch grains, clustered crystals of calcium oxalate,

and cells containing resin. The odour is characteristic, the taste at first sweet but afterwards acrid and disagreeable. Jalap, when assayed by the process described under 'Jalapæ Resina,' should yield not less than 9 nor more than 11 per cent. of resin having the properties of the official Resin.

Chemistry.—Resin (see below) 4 to 20 per cent., sugar, gum, starch, protein, etc.

Uses, etc.—As cathartic and diuretic. *Dose.*—5 to 20 grains.

B.P. Preparations.

Extractum Jalapæ - - alcoholic and aqueous; yield, about 30 per cent.

*Jalapæ Resina.

Pulvis Jalapæ Compositus - 1 part in 3.

„ Scammonii „ - 3 parts in 8.

Tinctura Jalapæ - - - containing 1·5 per cent. of Resin of Jalap, made with alcohol (70 per cent.)

**Contained in*

Pilula Scammonii Composita, 1 in 3 about.

B.P.C. Preparations.—Pilula Jalapæ Comp., Tinctura Jalapæ Comp., etc.

Jalap Resin is obtained by precipitating a tincture of the root with water; the precipitated resin is washed with hot water and dried at 100° C. By this means it is obtained in dark brown opaque fragments, translucent at the edges, brittle, breaking with a resinous fracture, readily reduced to a pale brown powder, sweetish in odour, acrid in the throat, easily soluble in rectified spirit (absence of other than resinous matters), insoluble in oil of turpentine (absence of colophony resin). A solution in alcohol is not coloured bluish-green by test solution of ferric chloride (absence of guaiacum resin). The powder yields little or nothing to warm water (absence of extractives), and not more than 10 per cent. to ether (absence of spurious jalap resin). The resin consists of *convolvulin (jalapin, jalapurgin)*, an ether-insoluble glucosidal resin mixed with a varying quantity of another resin soluble in ether, *scammonin* (also incorrectly termed *jalapin*), and traces of extractive matter. Convolvulin, when pure, is colourless, inodorous and tasteless, dissolved by alkalies and not re-precipitated by acids.

Uses, etc.—Same as the root. *Dose.*—2 to 5 grains.

B.P. Preparation.

Pilula Scammonii Composita.

Note.—Adulterations and Substitutions of Jalap.—*Male Jalap* (Jalap Stalks), from Ipomœa orizabensis, is often used to adulterate true Jalap, and the resin obtained from it has been substituted for Jalap resin. It occurs in irregular, light in colour and weight, rectangular, block-like pieces or in circular slices, the divided portions of a large root, which is often two feet long; or it may be entire, and spindle-shaped, not ovoid like Jalap. The resin, *jalapin* or *orizabin* (8 to 20 per cent.) is colourless, amorphous, translucent and wholly soluble in ether; it is regarded as being identical with scammonin.

Tampico Jalap, another common adulterant, from Ipomæa simulans, is generally smaller than true Jalap, fusiform or finger-like, more shrivelled or corky looking, often having deep wrinkles, and is devoid of transverse scars. It contains a resin, *tampicin* (10 to 15 per cent.), soluble in ether and homologous with jalapin.

Wild Jalap, from I. pandurata, containing 1·5 per cent. of an acid resin, is less frequently met with.

Kaladana, an Indian drug, consisting of the seed of I. hederacea, contains a resin, *pharbitisin*, identical with that obtained from I. purga.

BELLADONNÆ RADIX.—Belladonna Root.—The root of Atropa Belladonna, *Linn.*, collected in the autumn and dried.

N.O.—Solanaceæ.

Syn.—Deadly Nightshade.

Habitat.—Britain.

B.P. Characters.—In nearly cylindrical pieces, entire or longitudinally split, varying in diameter from about three-eights to three-quarters of an inch (ten to twenty millimetres), and usually from six inches to a foot (fifteen to thirty centimetres) or more in length. Externally it is of a pale greyish-brown colour, and is finely wrinkled longitudinally. The transverse fracture is short, and internally the root is whitish and starchy. Within and mostly near to the cambium ring are numerous scattered groups of vessels and fibres which should not exhibit a prominently radiate arrangement. Most of the parenchymatous cells contain small compound starch grains, and some are filled with numerous very minute crystals of calcium oxalate.

Note.—The fresh root loses on drying about 80 per cent. of water.

Chemistry—Hyoscyamine and its isomer *atropine* ($C_{17}H_{23}NO_3$) 0·1 to 0·6 per cent., *belladonnine* and occasionally *atropamine* (both anhydro-atropines probably derivatives of atropine); starch and *atrosin*, a red colouring principle. (For method for assay of root see *Pharm. Jour.* [3] xiv. 623). *Scopolamine* (*hyoscine*) is also present in traces, as is a fluorescent principle similar to that found in horse chestnut bark.

Uses, etc.—A powerful mydriatic (eye-pupil-dilating), sedative, narcotic and antihydrotic. *Dose.*—1 grain.

B.P. Preparations.

Atropina.

Extractum Belladonnæ Liquidum - - } containing 0·75 per cent. alkaloids

Which is used in the preparation of

Emplastrum Belladonnæ	,,	0·50	,,	,,
*Extractum Belladonnæ Alcoholicum - -	,,	1·00	,,	,,
Linimentum Belladonnæ	,,	0·375	,,	,,
Tinctura Belladonnæ	,,	0·05	,,	,,
Unguentum Belladonnæ	,,	0·60	,,	,,

**Contained in*

Suppositoria Belladonnæ (1½ grs. in each).

B.P.C. Preparations.—Emplastrum Belladonnæ Mitius, Collodium Belladonnæ, Cereoli Belladonnæ, etc.

Atropina P.B. ($C_{17}H_{23}NO_3$) is isomeric with hyoscyamine and can be easily obtained from the latter by the action of heat, of acids, and of weak alkalies. For its production Belladonna or Scopola root (*see* note) may be extracted with alcohol; to the tincture an excess of lime is added, and the filtered solution of the alkaloid so obtained is acidified with sulphuric acid and evaporated to remove alcohol; carbonate of potassium in excess is added to the acid solution, the precipitated alkaloid dissolved in alcohol, and the alcoholic solution, after decolorisation with animal charcoal, allowed to crystallize. The alkaloid so obtained is more or less impure, often containing the uncrystallizable alkaloid belladonnine. When pure it is in the form of colourless acicular crystals without odour, and having a bitter acrid taste. It melts at 115° C., is soluble in 300 parts of water, 1½ parts of alcohol, 16 parts of ether, 2 parts of chloroform, 50 parts of glycerine, and 15 parts of oleic acid. The aqueous solution has an alkaline reaction; powerfully dilates the pupil of the eye, and gives a yellow precipitate with perchloride of mercury. It may be distinguished from hyoscyamine by the difference (1) of its melting point; (2) of the melting point of its gold chloride; (3) of its optical properties. By the action of caustic baryta, atropine, or *tropyl-tropine*, is hydrolysed into a mixture of *tropic acid* ($C_9H_{10}O_3$), which has been prepared synthetically, and *tropine** ($C_8H_{15}NO$), which latter belongs to the class of alkines, and may be regarded as a pyridine substitution product. Conversely atropine has been obtained by heating together tropic acid and tropine. The sulphate of atropine is official, and is the most frequently used salt; the salicylate and borate are also used in eye surgery.

**Note.*—For relationship of tropine to *ecgonine*, see under Cocæ Folia.

Dose.—$\frac{1}{200}$ to $\frac{1}{100}$ grain.

B.P. Preparations of Atropine.

Atropinæ Sulphas.
Unguentum Atropinæ - - - 1 in 50.

B.P.C. Preparations of Atropine.—Atropinæ Salicylas, Cereoli Atropinæ, Chloroformum Atropinæ, Collodium Atropinæ, Oleinatum Atropinæ.

Atropinæ Sulphas P.B. $(C_{17}H_{23}NO_3)_2H_2SO_4$ may be obtained by neutralizing atropine with dilute sulphuric acid. It is a colourless crystalline salt, soluble in alcohol (fairly) and in water (readily).

Dose.—$\frac{1}{200}$ to $\frac{1}{100}$ grain.

B P. Preparations of Atropine Sulphate.

Lamellæ Atropinæ - - - $\frac{1}{5000}$ gr. in each.
Liquor Atropinæ Sulphatis - - 1 per cent.

B.P.C. Preparations of Atropine Sulphate.—Linimentum Atropinæ, Linimentum Atropinæ cum Chloroformo, Pilula Atropinæ et Morphinæ.

Homatropine ($C_{16}H_{21}NO_3$) is a frequently used artificial derivative of atropine. It is obtained by treating tropine (*vide*

supra) with *mandelic acid* [phenyl-glycollic acid, $C_6H_5CH(OH)$-COOH] which is obtained from amygdalin, the glucoside of almonds. The hydrobromide, HOMATROPINÆ HYDROBROMIDUM P.B., the form in which it is most frequently used, has been found of great service in ophthalmic surgery, since it is said to have a more powerful and at the same time more transient mydriatic action than atropine. *Dose.*—$\frac{1}{80}$ to $\frac{1}{20}$ grain. It is used in preparing

Lamellæ Homatropinæ - - - $\frac{1}{100}$ gr. in each.

HYOSCINÆ HYDROBROMIDUM P.B.—*See Hyoscyami Folia.*

Note.—Scopola.—The rhizomes of SCOPOLA CARNIOLICA (S. ATROPOIDES) and of S. JAPONICA (*Japanese Belladonna*), contain alkaloidal constituents practically identical with those of Belladonna root. Scopola is but little used in Great Britain, but is a valuable source of the alkaloid, and has for many years been used in America for making Belladonna plaster. The root of S. CARNIOLICA is official in the U.S.P. for the production of an extract and fluid extract. It should contain not less than 0·5 per cent of alkaloids.

Mandragora.—The root of MANDRAGORA OFFICINALIS (ATROPA MANDRAGORA, MANDRAGORA VERNALIS) contains a mydriatic alkaloid *mandragorine* ($C_{17}H_{27}NO_3$) which, in spite of the name and formula which have been assigned to it, is probably identical with atropine.

PHYTOLACCÆ RADIX.—Poke Root.—The root of Phytolacca decandra, *Linn.*, collected in August.

N.O.—Phytolaccaceæ.

Syn.—Garget.

Habitat.—North America (naturalized in Europe).

Characters.—Large, conical, branched and fleshy; mostly in transverse or longitudinal slices, wrinkled, grey, hard; fracture fibrous, the wood-bundles in several distinct, concentric circles; inodorous, sweetish and acrid.

Chemistry.—Starch, tannin, resin, *phytolaccic acid*, *phytolaccine* (alkaloid).

Uses, etc.—In rheumatism and skin diseases, also as emetic. Official in the U.S.P. for the production of a fluid extract; the B.P.C. includes a tincture. *Dose* (as an emetic).—10 to 30 grains.

RHEI RADIX.—Rhubarb Root.—The erect rhizome or so-called root of Rheum palmatum, *Linn.*; Rheum officinale, *Baill.*; and probably other species [*Bentl. and Trim. Med. Pl.* vol. iii. plates 213 and 214]; collected in China and Thibet, deprived of more or less of its cortex, and dried.

N.O.—Polygonaceæ.

Habitat.—The western and north-western provinces of China.

B.P. Characters.—In cylindrical, barrel-shaped, conical, plano-convex, or irregularly formed pieces; the surface sometimes covered with a bright yellowish-brown powder; rounded or somewhat angular, usually smooth, and marked with reddish-brown or dark rusty-brown lines, intermixed in a yellowish-brown or greyish substance, and nearly always presenting small scattered starlike marks. Frequently the pieces are bored with a hole, which sometimes contains a fragment of

cord used to suspend them while drying. The pieces are hard and compact; fracture uneven, presenting a marbled appearance, and in some cases a rhomboidal network of reddish lines. Odour characteristic, somewhat aromatic; taste bitter, feebly astringent; when chewed the root is gritty between the teeth.

Varieties.—The geographical source of all official rhubarbs is the same. The roots are dug up in autumn, when six years old, cleansed, peeled, and cut into pieces; these are bored through the centre, strung on a string and dried in the sun. The variety formerly known as "Turkey" rhubarb received its name because it came to us by way of Asiatic Turkey; this has long ceased to be an article of commerce. The variety known as Russian crown or Muscovitic rhubarb, which came to us by way of the Russian frontier town Kiachta, is also no longer obtainable; it consisted of carefully trimmed pieces, with the cortical portion removed and pierced with conical holes. Chinese or East Indian rhubarb comes either directly from China (Kansu, Szechuen, Shensi, etc.) by way of Shanghai, or indirectly by way of Singapore and other East Indian ports. The drug occurs in varieties known as Shenshi and Canton, the former being the more esteemed, the latter comprising the bulk of commercial rhubarb. In commerce the pieces are classed as "flats" and "rounds;" good pieces are never spongy, decayed, worm-eaten or mouldy. The grittiness, which is characteristic of Asiatic rhubarb, is due to the presence of a large percentage of calcium oxalate in the form of raphides.

Chemistry.—The active principles of rhubarb may be divided into two classes, the anthraglucosides and the tanno-glucosides, the former being the group to which the purgative action is attributed, the latter having astringent properties. The anthraglucosides have been considered to be loosely combined in the substance *rheopurgarin*, they are *emodin*, *rhein*, *chrysophanein* and *rheochrysin*. Tanno-glucosides yield rheo-tannic acid (rhubarb red) on hydrolysis. The resinous constituents of rhubarb termed as *phæoretin*, *aporetin*, and *erythroretin* have since been described as decomposition products. Chrysophanic acid ($C_{15}H_{10}O_4$) produced by the decomposition of chrysophanein, is tasteless, yellow, crystalline, freely soluble in benzol and chloroform, almost insoluble in water; it is nearly allied chemically to emodin on the one hand and alizarin on the other. "Cathartic acid" is probably a mixture. The drug also contains starch and calcium oxalate, the latter in very varying amount. It should be borne in mind that the chemistry of Rhubarb cannot yet be regarded as fully elucidated.

Note.—Constituents of Rhubarb of the Anthracene group.—The following formulæ are instructive:—

Anthracene	$C_{14}H_{10}$.
Alizarin (dioxyanthraquinone)	$C_{14}H_6O_2(OH)_2$.
Chrysophanic acid	$C_{14}H_5O_2(CH_3)(OH)_2$.
Emodin	$C_{14}H_4O_2(CH_3)(OH)_3$.
Rhein	$C_{14}H_3O_2(CH_3)(OH)_4$.

The three last named substances are thus shown to be substituted anthraquinones, and are the *di-*, *tri-* and *tetr-oxyquinones* respectively of *methyl anthracene*.

Rhein has more recently been described by Tschirch as the methylene ester of tetraoxyanthraquinone $C_{14}H_4(OH)_2(O_2CH_2)O_2$.

Uses, etc.—As tonic, astringent and purgative, rhubarb is one of the commonest and most widely used drugs in medicine.

B.P. Preparations.

Extractum Rhei - - -	prepared with alcohol (60 per cent.)
Infusum „ - - -	1 part in 20.
Liquor Rhei Concentratus - -	1 „ 2 of alcohol (20 per cent.)
Pilula Rhei Composita - -	1 part in 4, about.
Pulvis Rhei Compositus - -	1 „ $4\frac{1}{2}$.
Syrupus Rhei - - - -	1 „ 15, about.
Tinctura Rhei Composita - -	1 „ \ 10 of a mixture of alcohol (60 per cent.) and glycerin.

B.P.C. Preparations.—Extractum Rhei Liquidum, Elixir Rhei, Infusum Rhei Concentratum, Tinctura Rhei Aquosa, etc.

Other Preparations.—Of these the more important are fluid extract (1 in 1) and pill (U.S.P.), tincture (P.L.). Compound extracts of rhubarb containing various proportions of Ext. Rhei, Aloes and Jalap are included in many of the Continental Pharmacopœias.

Note.—English Rhubarb is derived from RH. RHAPONTICUM (a native of Siberia), which is cultivated chiefly at Banbury, in Oxfordshire. It occurs in pieces of various sizes and shapes, the cylindrical and flat predominating; all are light, spongy, somewhat friable, and very mucilaginous. Internally they have a marbled appearance, the pinkish streaks being arranged in a parallel or somewhat radial manner. The taste is less bitter, and the grittiness less marked because the amount of raphides present is much less than in the official drug. Its powder is of a bright yellow colour. RH. OFFICINALE has also been cultivated in England.

French and German Rhubarb are derived from RH. RHAPONTICUM RH. PALMATUM, RH. EMODI, RH. COMPACTUM, RH. UNDULATUM, which are collected in various parts of the Continent.

ADULTERATIONS.—The pieces were formerly rubbed over with turmeric powder to heighten the colour; powdered rhubarb is now used for this purpose. The powder is said to be adulterated with flour and turmeric, and also with the powdered English variety, but this sophistication is rarely practised. Flour is not easy to detect because of the presence of starch in genuine rhubarb; the turmeric may be detected by means of an alcoholic solution of boric acid.

RUMEX CRISPUS.—Yellow Dock.—The root of Rumex crispus, *Linn.*, and other species of Rumex.

N.O.—Polygonaceæ.

Syn.—Radix lapathi.

Habitat.—Europe.

Characters.—From eight to twelve inches long, about half an inch thick, somewhat fusiform, fleshy, nearly simple, annulate above, deeply wrinkled below; externally rusty-brown, internally whitish, with fine, straight, interrupted reddish medullary rays, and a rather thick bark; astringent, bitter taste; little or no smell.

Chemistry.—Tannic acid and *rumicin*, which is said to be identical with chrysophanic acid.

Uses, etc.—As an astringent and tonic; in large doses laxative. *Dose.*—15 to 60 grains.

SASSAFRAS RADIX.—Sassafras Root.—The dried root of Sassafras officinale, *T. Nees and Eberm.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 220].

N.O.—Lauraceæ.

Habitat.—North America.

B.P. Characters.—In large branched billets, more or less covered with bark. Bark rough and greyish-brown or rusty-brown externally; internally smooth, glistening and rusty-brown, with an agreeable, aromatic odour, and a peculiar, aromatic, somewhat astringent, taste. Wood soft, light in weight, greyish-yellow or greyish-red, with a similar taste and odour to the bark, but more feeble.

Chemistry.—Volatile oil (1 to 2 per cent.) is the essential constituent, to it the odour and taste are due. The oil has a S.G. 1·08, and when exposed to cold deposits crystals of *sassafras camphor*. It consists of *safrol* ($C_{10}H_{10}O_2$), 80 per cent. (S.G. 1·108), the bulk of the remainder being a camphor and a mixture of hydrocarbons of the terpene class, including *phellandrene* and *pinene*. Traces of *eugenol* are also present. Safrol has been shown to be the *methylene ether* of *allyl-pyrocatechin*, and is a substance found in numerous other oleiferous drugs; both the oil and safrol itself are official in the U.S.P. The other constituents of the root are tannic acid and about 9 per cent. of a red colouring matter, resembling cinchona red, called *sassafrid* produced by oxidation of the tannin.

Uses, etc.—Mostly as a flavouring agent. It has stimulant and diaphoretic properties.

B.P. Preparation.

Liquor Sarsæ Compositus Concentratus - - 1 in 10.

Note.—The *bark* and *pith* of Sassafras are both included in the B.P. Codex and in the U.S.P. The former is given in infusion and has much the same composition as the wood, but is richer in essential oil; the latter, which occurs in slender cylindrical, often curved or coiled, spongy pieces, consists of parenchymatous tissue, and contains a large quantity of mucilage which is not precipitated from solution from alcohol; it is useful on account of its demulcent properties (Mucilago Sassafras Medullæ B.P.C.).

EUPHORBIA.—Spurge.—The root of Euphorbia Ipecacuanha, *Linn.*

N.O.—Euphorbiaceæ.

Syn.—American or wild Ipecac.

Habitat.—United States.

Characters.—Several or many headed, branches of the head short or sometimes two inches long, somewhat knotty and marked with stem scars; roots more than twelve inches long, about $\frac{3}{8}$-inch thick, nearly cylindrical, somewhat branched, light brown, wrinkled, fracture short; bark somewhat

thick, white internally; wood yellowish, spongy; inodorous, sweetish, somewhat bitter, slightly acrid.

Chemistry.—Tannin, resins containing *euphorbon* (probably the active constituents), starch.

Uses, etc.—Cathartic and emetic, formerly official in the U.S.P. *Dose.*—5 to 20 grains.

Note.—EUPHORBIA COROLLATA, the large flowering spurge, has roots similar to the above, with similar medicinal properties; like the latter it was formerly official in the U.S. Numerous other species of Euphorbia are employed medicinally in the countries where they are indigenous, *e.g.*, E. PROSTRATA, E. MACULATA, E. HUMISTRATA, E. HYPERICIFOLIA, etc.

STILLINGIA.—Queen's Root.—The root of Stillingia sylvatica, *Linn.* (Sapium sylvaticum).

N.O.—Euphorbiaceæ.

Syn.—Silver leaf.

Habitat.—United States of America.

Characters.—About twelve inches long and nearly two inches thick, sub-cylindrical, slightly branched, compact, wrinkled, tough, greyish-brown; breaking with a fibrous fracture, showing a thick bark and porous wood, the inner bark and medullary rays with numerous brown resin cells; odour peculiar, unpleasant; taste bitter, acrid, pungent.

Chemistry.—The pungency is due to a resinous constituent *sylvacrol*, which is soluble in alcohol and to a volatile oil. Starch and tannic acid are also present.

Uses, etc.—Said to be useful in syphilitic diseases; is emetic and alterative, official in the U.S.P. *Dose.*—15 to 30 grains.

Preparations.—Fluidextractum Stillingiæ, U.S.P., Mistura Stillingiæ composita, Syrupus Stillingiæ compositus, N.F.

Note.—STILLINGIA SEBIFERA (the Chinese tallow-tree), has a fruit containing a fat which is known as *Chinese Tallow*; the latter consists of a mixture of palmitin and stearin, and melts at 44·5° C. The seeds themselves yield Stillingia or tallow seed oil possessing drying properties.

SALEP.—Salep.—The unbranched tubers of different species of Orchis and allied genera, as O. mascula, O. militaris, O. mario, O. ustulata, Anacamptis pyramidalis, Platanthera bifolia, etc.

N.O.—Orchidaceæ.

Syn.—Radix Satyrii.

Habitat.—Persia and Southern and Central Europe.

Characters.—Oriental salep is one to two inches long and usually dark coloured; European salep is always smaller. It is globular, pyriform, ovate or oblong in shape; somewhat flattened or wrinkled, with the scar of the terminal bud at the apex; of a pale brownish-yellow colour, somewhat translucent, of a horny texture, hard, inodorous, and of an insipid, very mucilaginous taste. Its powder is of a yellowish colour.

Chemistry.—Starch (27 per cent.); mucilage (48 per cent.) sugar (1 per cent.); nitrogenous substances (5 per cent.); ash (2 per cent.). The mucilage is not extracted by cold water.

Uses, etc.—Salep is nutritive and demulcent and on account of its confining effect upon the bowels has been recommended as an article of diet for infants and invalids suffering from chronic diarrhœa. Mixed with fifty parts of boiling water, one part of salep forms a jelly. The German Pharmacopœia has a mucilage of salep.

SARSÆ RADIX.—Sarsaparilla.—The dried root of Smilax ornata, *Hook. f.* [*Bot. Mag.* tab. 7054]. Imported from Costa Rica and commonly known as Jamaica sarsaparilla. (Formerly exported *via* Jamaica).

N.O.—Liliaceæ.

Syn.—Jamaica Sarsaparilla.

Habitat.—Central America.

B.P. Characters.—Very long, nearly cylindrical, tough, flexible roots, of a greyish-brown or dark reddish-brown colour, folded together and bound with a root of the same plant into bundles of about eighteen inches (half a metre) in length, and four or five inches (ten to twelve and a half centimetres) in diameter. The roots are usually three-sixteenths of an inch (five millimetres) in thickness, are deeply wrinkled longitudinally, and provided with numerous rootlets. The transverse section usually exhibits a reddish-brown cortex and yellowish-white wood. The cells of the endodermis are nearly square in transverse section, and uniformly thickened. Sarsaparilla has no odour, and only a slightly bitter taste.

Chemistry.—The active constituents are three saponin-like glucosides, *sarsa-saponin*, *smila-saponin* and *parillin* of which the first named is the most active and important. A trace of volatile oil, starch and dark extractive matters are also present. The acridity of sarsaparilla is a measure of its value; old roots, and those from inferior species, are more or less inert, owing no doubt, in the former case, to the decomposition of the glucosidal active constituents.

Uses, etc.—First introduced as a remedy for venereal diseases, sarsaparilla has been widely used in medicine. Its efficacy is much doubted, though it has been recently highly commended as an alterative and is still much used as an ingredient in "blood purifying" specifics.

B.P. Preparations.

Extractum Sarsæ Liquidum	1 in 1.
Liquor Sarsæ Compositus Concentratus	1 in 1.

Preparations other than B.P.—Compound fluid extract and compound syrup, U.S.P.

Varieties of Sarsaparilla.—Commercially they are classed as *mealy* and *non-mealy* according to the amount and nature of the starch which they contain. To the mealy class belong the *Honduras*, *Guatemala*, *Brazilian* (or *Para*) and *Caraccas* varieties. They are generally swollen, powdery when broken, and have frequently transverse cracks or rings; a decoction is coloured by iodine solution. An extract prepared from these will be only partially soluble in water, and will form a turbid solution from the presence of starch. In a transverse section the mealy coat is but little altered by sulphuric acid, while the woody zone becomes purplish or almost black; sometimes the pith also acquires a darkish tint. To the non-mealy class belong the *Jamaica*, *Lima*, *Mexican* (or *Vera Cruz*) and *Guayquil* varieties.

These have generally a thin cortical portion which is red or brown in colour, and the transverse section gives, with sulphuric acid, a red or purple throughout. The presence of starch is not so evident in the decoction, and the aqueous extract dissolves clear in water. Native Jamaica (from plants cultivated in Jamaica) is an orange red root otherwise resembling the official variety and imported in short, thick rolls. Mexican root is distinguishable by the presence of a portion of rhizome and by the loose, slightly bound character of the rolls.

CHINÆ RADIX.—China Root.—The root of Smilax China, *Linn.*

N.O.—Liliaceæ.

Habitat.—China, Japan and East India.

Characters.—Irregularly cylindrical tubers, from four to six inches in length and from one to two inches in thickness; usually somewhat flattened and producing short knobby branches; covered with a rusty-coloured, somewhat shiny bark, which may be either smooth or wrinkled; internally of a pale fawn colour, mealy, showing small resin cells; inodorous and insipid.

Chemistry.—Probably similar to that of sarsaparilla.

Uses, etc.—Obsolete in Europe; in China and India a remedy for syphilitic diseases.

ARUM.—Cuckoo-pint.—The tuberous root of Arum maculatum

N.O.—Aroidaceæ.

Habitat.—Indigenous.

Characters.—Oblong in shape, about the size of a pigeon's egg; brownish externally, white within, and, when fresh, fleshy and yielding a milky juice, which is almost insipid to the taste at first, but soon produces a burning and pricking sensation which lasts for some time. This acridity is lost during the process of drying.

Chemistry.—Starch, sugar, gum, resin, albumin, fat and extractive matter. There is also present a volatile acrid principle, which is soluble in ether. *Saponin* has also been found, and it is supposed that a volatile alkaloid is present in the tuber.

Uses, etc.—The source of the so-called *Portland arrowroot*, now obsolete. In the fresh state the tubers act as an irritant when applied externally.

Note.—The American Arum, ARUM TRIPHYLLUM (*Dragon root, Indian turnip*), has similar characters and properties to the above.

3. RHIZOMES.—RHIZOMATA.

General Morphology of Rhizomes —The rhizome is an oblique or prostrate stem growing perennially on or under the ground, and producing aërial shoots either at the apex from terminal, or laterally from axillary buds. The roots or rootlets arise on the under surface normally at the points from which the aërial stems are given off, these points being termed the *nodes*. Rhizomes are frequently thickened by the presence of contained reserve food material, *e.g.*, ginger, etc., and in such cases each year's growth is usually marked by scars left after the fall of the aërial stems or branches, at the end of the active period of growth. Rhizomes are *monopodial* or *sympodial* according to whether they grow by means of a terminal or an axillary bud.

A *corm* is a subterranean fleshy stem of rounded or depressed figure, some buds of which produce fresh corms, whilst others produce aërial stems bearing leaves and flowers. Corms are either *naked* (*e.g.* cyclamen) or *tunicated* (*e.g.*, crocus, colchicum).

A *bulb* consists of an underground stem reduced to a flat plate and giving off aërial growths and fresh bulbs from its upper surface and rootlets from below. The aërial bud is surrounded by fleshy scale-like leaves which contain the food material which in the corm resides in the cauline or stem portion (*e.g.*, squill, tulip). The bulb is said to be *scaly* when the fleshy leaves are small, thick and imbricate, whilst in the case of the *tunicated* bulb the leaves are of varying thickness and form concentric layers, the outer ones being thin and papery.

General Histology of the Rhizome.—The histological characters of the rhizome are similar to those of the stem. In the Dicotyledons an external jacket of flattened cork cells (replacing the epidermis of the young rhizome) forms the outer layer (*periderm*) of the bark. Internally to this a layer of parenchymatous tissue encloses the *bast* or *phlöem*, and separating the latter from the *wood* or *xylem*, is the cylinder of *cambium* cells, by the activity of which the increase in thickness of the rhizome takes place. The wood or xylem is arranged usually in the form of wedges, alternating with the *medullary rays* and enclosing a central cylinder of *pith*. The so-called bark of rhizomes and stems is commonly spoken of as consisting of an inner and an outer portion. The *inner bark*, *liber* or *endophlœum*, is identical with the bast or phloëm, whilst the *outer bark* consists of two layers, an inner parenchymatous *mesophlœum* and an outer *epiphlœum* consisting of cork cells and synonymous with the periderm.

In Monocotyledons (Zingiber, etc.) the arrangement of the tissues differs entirely from that described above; here the rhizome consists of parenchymatous tissue covered externally by an epidermal or cortical layer, and enclosing an internal cylinder through which vascular bundles are irregularly scattered. Hence there is no separable bark and the growth in circumference of the normal monocotyledonous stem or rhizome is limited by the extensibility of the outer rind.

General Chemical Characters of Rhizomes.—These are very similar to those described under "Roots," which see.

CIMICIFUGÆ RHIZOMA.—Cimicifuga.—

The dried rhizome and roots of Cimicifuga racemosa, *Ell.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 8].

N.O.—Ranunculaceæ.

Syns.—Acteæ Racemosæ Radix; Black Snake root; Black Cohosh.

Habitat.—United States and Canada.

B.P. Characters and Test.—The rhizome is from about two to six inches (five to fifteen centimetres) long, and from half an inch to an inch (twelve to twenty-five millimetres) in diameter, hard, nearly cylindrical in shape, and bears the remains of numerous stout ascending branches marked with encircling leaf-scars. The roots are brittle and usually broken off near the rhizome; they exhibit in transverse section from three to five wedge-shaped wood-bundles, separated by as many broad medullary rays. Both rhizome and roots are blackened by *test-solution of ferric chloride* (presence of tannic acid). Odour faint; taste bitter and acrid.

Chemistry.—A crystalline neutral principle, *racemosin*, soluble in alcohol and in chloroform is said to have been isolated and there are also present starch, astringent acids (which cause a blackness with ferric chloride solution), resin and a little volatile oil.

Uses, etc.—Has found frequent and successful use in various nervous diseases, rheumatism, etc.; it is said to have a well-marked action on the uterus. *Dose* (in powder).—20 grains.

B.P. Preparations.

Extractum Cimicifugæ Liquidum	1 part in 1 of alcohol (90 per cent.)
Tinctura Cimicifugæ	1 part in 10 of alcohol (60 per cent.)

Preparations other than B.P.—Fluidextract U.S.P., tincture U.S.P., and Cimicifugin (Macrotin), which is a precipitated resinoid.

Note.—Actæa Spicata (*Baneberry*) a native of Central Asia and Europe, has a rhizome and rootlets closely resembling the above, except in being shorter, thinner, and of a blackish-grey colour. The constituents also are similar to those of Cimicifuga. This drug is used in domestic medicine and has an emeto-cathartic action. The rhizome of black hellebore is similar in appearance to Cimicifuga, but is distinguishable by the absence of tannin reaction with ferric chloride solution.

HYDRASTIS RHIZOMA.—Hydrastis Rhizome.

—The dried rhizome and roots of Hydrastis canadensis, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 1].

N.O.—Ranunculaceæ.

Syns.—Yellow Root; Golden Seal; Indian Turmeric.

Habitat.—Canada and United States.

B.P.Characters—The rhizome is tortuous, simple or branched, from half an inch to an inch and a half (twelve to thirty-eight millimetres) long and from one-eight of an inch to half an inch (three to twelve millimetres) in thickness. The upper surface bears short ascending branches, which are usually terminated by cup-shaped scars. From the lower surface and sides numerous thin brittle roots are given off. The rhizome is yellowish-brown, becoming darker by age. It breaks with a clean resinous fracture; the smooth fractured surface is of a brownish-yellow or greenish-yellow colour, and exhibits a ring of bright yellow somewhat distant narrow wood bundles. It has a slight but characteristic odour and a bitter taste.

Chemistry.—There are present two alkaloids, viz., 3 to 4 per cent. of *berberine* ($C_{20}H_{17}NO_4$), insoluble in chloroform, and forming yellow salts, and *hydrastine*, 2 to 3 per cent. ($C_{21}H_{21}NO_6$), soluble in chloroform, forming white salts, and yielding, on oxidation, opianic acid and *hydrastinine*. A third alkaloid, *canadine* ($C_{20}H_{21}NO_4$), has been shown to be present, and is regarded as being *tetra-hydroberberine*. The U.S.P. requires Hydrastis to yield not less than 2·5 per cent. of Hydrastine.

Uses, etc.—Tonic, astringent, stomachic; formerly much used by the American aborigines.

B.P. Preparations.

Extractum Hydrastis Liquidum -	1 part in 1 of alcohol (45 per cent.)
Tinctura Hydrastis - -	1 part in 10 of alcohol (60 per cent.)

B.P.C. Preparations.—Hydrastina, Hydrastinina, Hydrastininæ Hydrochloridum, Extractum Hydrastis and Glycerinum Hydrastis.

Note.—Non-official Preparations.—*Hydrastin* was the name given to an eclectic remedy prepared by precipitating an alcoholic extract of the root with water; it consisted chiefly of hydrochloride of berberine.

HELLEBORUS.—Black Hellebore.—The dried rhizome and roots of Helleborus niger, *Linn.*

N.O.—Ranunculaceæ.

Syn.—Christmas Rose.

Habitat.—Europe.

Characters and Tests.—Rhizome irregularly twisted, one or more inches long, quarter to half inch thick, marked longitudinally and transversely; roots long and brittle; black externally, whitish internally. Meditullium of rootlets, homogeneous. No marked odour, but with bitter taste. A solution of ferric chloride has no action on a cold aqueous infusion.

Chemistry.—Helleborin ($C_{36}H_{42}O_6$) and *helleborein* ($C_{26}H_{44}O_{15}$), two poisonous glucosides; helleborin is insoluble, helleborein soluble, in cold water; resin, fat and starch are also present, but tannin is absent.

Uses, etc.—Said to have been used as a purgative since B.C. 1400. *Dose.*—5 to 20 grains in powder. An extract (alcoholic) was formerly official in the U.S.P. and a tincture is contained in the B.P.C.

Note.—Helleborus Viridis (*Green Hellebore*) is not to be confounded with Veratrum Viride which is also sometimes known as green hellebore. It has a rhizome much resembling that of the preceding, but it is of smaller dimensions, and contains more helleborin than the black variety.

Helleborus fœtidus—*Bears' foot, stinking hellebore*—contains principles similar to those found in other species of hellebore. The leaves, in the form of either powder or decoction, are used for the expulsion of tænia. *Dose.*—5 to 20 grains.

COPTIDIS RHIZOMA.—Coptis Rhizome.—The dried rhizome of Coptis Teeta, *Wall.*, imported into Bengal from Assam.

N.O.—Ranunculaceæ.

Syn.—Mahmira, Tita.

Habitat.—Mishmi Mountains, East of Assam.

Characters.—A woody rhizome of the thickness of a small goose quill, and from one to two inches in length, often contracted at one extremity into a short woody stem. The surface is usually rough, irregular, more or less annulated, and marked with the remains of roots in the shape of short shiny points. Externally of a yellowish-brown colour; internally much brighter; frequently of a golden yellow colour, exhibiting in fracture a radiating structure.

Chemistry.—Berberine (8 per cent.) and a yellow, bitter principle; no tannin is present.

Uses, etc.—Official in Pharmacopœia of India as a pure, bitter tonic.

Note.—The coptis (Gold thread) of the United States is derived from Coptis trifolia; it contains *berberine* and also, it is said, *coptine*, a white alkaloid.

MENISPERMUM—Canadian Moon-seed.—The rhizome and roots of Menispermum Canadense, *Linn.*

N.O.—Menispermaceæ.

Syn.—Yellow Parilla.

Habitat.—Canada and U.S.A.

Characters.—Rhizome several feet long, about a quarter of an inch thick, yellowish-brown or brown, finely wrinkled longitudinally, and beset with numerous thin, rather brittle roots; fracture tough, woody; internally reddish, with a thickish bark, a circle of porous, short, nearly square, wood wedges, and a large, central pith; nearly inodorous; taste bitter.

Chemistry.—A white alkaloid *menispine*, a little berberine, together with starch and resin.

Uses, etc.—Tonic and diuretic. *Dose.*—15 to 60 grains. Formerly official in the U.S.P. for the production of a fluid extract.

PODOPHYLLI RHIZOMA—Podophyllum Rhizome.

—The dried rhizome and roots of Podophyllum peltatum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 17].

N.O.—Berberidaceæ.

Syns.—Podophyllum Root; Mandrake; May Apple.

Habitat.—North America.

B.P. Characters—Dark reddish-brown, smooth or only slightly wrinkled, nearly cylindrical pieces, several inches in length, and from about one-fifth to one-third of an inch (five to eight millimetres) in thickness. The rhizome is enlarged at intervals of about two inches (five centimetres), and the upper surface of each enlargement is marked by a depressed circular scar, below which, on the under surface, are rather stout brittle brown roots, or the scars corresponding to them. It breaks with a short fracture, and internally is either nearly white and starch-like, or pale yellowish-brown and horny. The odour is characteristic, the taste slightly bitter and acrid.

Chemistry.—Resin, 3 to 5 per cent., sugar, starch, fat, etc. The chief constituent of the resin is *podophyllotoxin* ($C_{15}H_{14}O_6$) a neutral crystalline body which when acted upon by alkalies becomes hydrated to *podophyllic acid*, the latter readily losing the water and forming *picropodophyllin* isomeric with podophyllotoxin. A purgative amorphous resin *podophylloresin* is also present together with a yellow colouring matter identical with the *quercetin* of quercitron bark.

Uses, etc.—A powerful hepatic and intestinal stimulant. *Dose.*—5 to 15 grains in powder.

B.P. Preparations.

Resina Podophylli.	
Tinctura Podophylli - -	1 of resin in 30 of alcohol (90 per cent.)

The *B.P.C.* includes Tinctura Podophylli Ammoniata and several other preparations of the resin.

Resina Podophylli P.B.—The resin is prepared by making a tincture of the rhizome, removing from this the greater part of the spirit by distillation, and pouring the remaining liquor into water acidified with hydrochloric acid. By this means the resin is precipitated and may be collected and dried. The use of hydrochloric acid, ordered by the '67 B.P., was for a time abandoned, since it was supposed to cause the decomposition of the podophyllotoxin (*see* Chemistry of Rhizome above), but it is now again officially adopted. The resin is not infrequently adulterated either with the powdered rhizome or with mineral matter, the presence of the latter

being in some cases no doubt due to the use of such salts as alum in the precipitation. The colour of the resin varies considerably, and cannot be regarded as being a criterion of its quality. The resin should not, however, give more than about 1 per cent. of ash on incineration, while alcohol and ammonia water should dissolve it almost entirely. An ammoniated tincture of the resin is recommended on account of its miscibility with water.

Note.—Indian Podophyllum is the rhizome and roots of PODOPHYLLUM EMODI. The resin which is official in the Indian and Colonial Addendum is present to fully double the extent compared with the American drug, and is stated to have a similar chemical composition containing however a greater proportion of podophyllotoxin. Therapeutically the Indian resin has been variously described as of less, equal and greater activity than the B.P. preparation. It is distinguishable by reason of its greater insolubility in Ammonia, a sample of resin from P. EMODI yielding 58 per cent. insoluble while several samples of the official resin gave from 7 to 12 per cent. only insoluble.

CAULOPHYLLUM. Blue Cohosh.—The rhizome and roots of Caulophyllum thalictroides, *Michaux*.

N.O.—Berberidaceæ.

Syns.—Pappoose Root; Squaw Root; Blueberry Root.

Habitat.—United States and Canada.

Characters.—Rhizome four inches long, one quarter to two-fifths of an inch thick, bent, marked above with stem scars and knotty branches, and having below numerous long, thin, rough and matted roots.

Chemistry.—A glucoside *leontin* (allied to saponin), resin, an alkaloid *caulophylline*, tannin and fat are present.

Uses, etc.—Antispasmodic, diuretic, etc. *Dose.*—15 to 30 grains. Formerly official in the U.S.P., is included in the B.P.C. for the preparation of a fluid extract and compound solution with Pulsatilla. *Caulophyllin* of the eclectics is a precipitated resinoid.

SANGUINARIÆ RHIZOMA.—Blood Root.—The rhizome of Sanguinaria canadensis, *Linn.*, collected in autumn.

N.O.—Papaveraceæ.

Syns.—Indian paint; Tetterwort.

Habitat.—United States of America and Canada.

Characters.—About two inches long, and two-fifths of an inch thick, horizontal, cylindrical, somewhat branched, faintly annulate, wrinkled, reddish brown; fracture short, somewhat waxy, whitish, with numerous small, red resin cells, of a nearly uniform brownish-red colour; bark thin; odour slight; taste persistently bitter and acrid.

Chemistry.—The root contains four alkaloids, viz.:—*Chelerythrine* ($C_{21}H_{17}NO_4$), *sanguinarine* ($C_{20}H_{15}NO_4$), *homochelidonine* ($C_{21}H_{21}NO_4$), and *protopine* ($C_{20}H_{19}NO_5$). The first-named is present in greatest quantity, and the two latter are said to be identical with two alkaloids found in Chelidonium majus. Starch, citric and malic acids are also present.

Uses, etc.—Alterative, expectorant, emetic. *Dose* (as emetic)—10 grains. The B.P.C. and U.S.P. include a fluid extract and tincture.

GERANIUM.—Geranium.—The rhizome of Geranium maculatum, *Linn.*

N.O.—Geraniaceæ.

Syn.—Cranesbill.

Habitat.—Europe, Canada and United States of America.

Characters.—Horizontal, cylindrical, two or three inches long, half an inch or less thick, longitudinally wrinkled, dark brown; fracture short,

pale red brown; bark thin, wood wedges yellowish, small, forming a circle near the cambium line; medullary rays broad, central pith large, roots thin, fragile; inodorous; taste astringent.

Chemistry.—Tannic acid (9·7 to 27·8 according to the month of collection), starch, pectin, sugar and mucilage

Uses, etc.—Tonic, astringent. *Dose.*—15 to 45 grains. Official in the U.S.P. for the production of a fluid extract.

TORMENTILLÆ RHIZOMA—Tormentil Rhizome.—The rhizome of Potentilla Tormentilla, *Neck.*

N.O.—Rosaceæ.

Syn.—Tormentil.

Habitat.—Europe.

Characters.—Large, cylindrical or roundish, hard, irregular, twisted and branched, of a blood-red or brownish colour internally, and dark red-brown externally. The transverse fracture is not dotted. Taste astringent, not acrid.

Chemistry.—Contains *tannic acid* (18 to 30 per cent.), kinovic acid, a little volatile oil, gum, and a colouring matter, *tormentil red* (18 per cent.), which is soluble in alcohol, but insoluble in water.

Uses, etc.—Tonic, astringent. *Dose.*—10 to 30 grains.

GEUM URBANUM.—Avens.—The dried rhizome and roots of Geum urbanum, *Linn,*

N.O.—Rosaceæ.

Syn.—Radix Caryophyllatæ.

Habitat.—Europe.

Characters.—Short, oblong, from a quarter to half an inch thick, brown externally, white within, with a reddish centre, and furnished with numerous long descending fibres. Inodorous or slightly clove-like when fresh. taste bitterish and astringent.

Chemistry.—A little volatile oil, *geum-bitter,* tannic acid, gum, resin and lignin.

Uses, etc.—Astringent, tonic, *Dose.*—15 to 30 grains.

Note.—GEUM RIVALE (*Water avens, purple avens*) has a perennial horizontal, jointed, tapering root, six inches in length, reddish-brown in colour, and having many yellowish root fibres. It is a powerful astringent, and has tonic properties.

ARALIÆ RHIZOMA.—American Spikenard.—The dried rhizome and roots of Aralia racemosa, *Linn.*

N.O.—Araliaceæ.

Habitat.—United States.

Characters.—Short, two or more inches thick, furnished with closely placed large stem-scars and numerous much-branched roots, from one to two feet long. The odour is fragrant, the taste aromatic, sweetish and spicy.

Chemistry.—Volatile oil, resin, tannin, protein, etc.

Uses, etc.—As stimulant, diaphoretic and alterative. *Dose.*—In decoction the same as that of sarsaparilla.

Note.—ARALIA SPECIES.—*False sarsaparilla* (*Wild Liquorice, Shotbush*) is the American name given to A. NUDICAULIS, which has properties similar to the above, A. HISPIDA and A. CALIFORNICA are also nearly allied. The *prickly elder* (A. SPINOSA) contains a glucoside *aralin.*

VALERIANÆ RHIZOMA.—Valerian Rhizome.

—The dried erect rhizome and roots of Valeriana officinalis, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 146]. Collected in the autumn.

N.O.—Valerianaceæ.

Syn.—Valerian Root.

Habitat.—Britain.

B.P. Characters.—A short erect rhizome, entire or sliced, dark yellowish-brown externally, and giving off numerous slender brittle roots three or four inches (seven and a half to ten centimetres) long, of the same colour as the rhizome; rhizome and roots whitish or yellowish internally. The odour that is developed in the process of drying is strong, characteristic, and disagreeable; taste unpleasant, camphoraceous, and slightly bitter.

This rhizome somewhat resembles Serpentary rhizome, but may be distinguished therefrom by its erect method of growth, odour, and by the roots being thicker, shorter, and less brittle. The roots of Veratrum album and Veratrum viride are paler in colour, larger, and more shrivelled.

Chemistry.—The valuable constituent, is the *volatile oil* (½ to 1 per cent.) which contains *pinene*, *camphene*, *borneol* and the *formic*, *acetic* and *valerianic* esters of the latter. Valerianic acid is not a natural constituent of the volatile oil, but results from the decomposition of the above-named ester, the relative proportions of the acid and the volatile oil varying according to the age of the rhizome. Resinous extractive, sugar, malic acid and alkaloidal matter are also present. It has been recently claimed that the fresh juice possesses more powerful therapeutic properties and gives more marked reactions for alkaloidal matter.

Uses, etc.—As nervous stimulant and antispasmodic. *Dose.*—10 to 30 grains in powder.

B.P. Preparation.

Tinctura Valerianæ Ammoniata - - 1 in 5.

B.P.C. Preparations.—Extractum Valerianæ, Extractum Valerianæ Liquidum, Infusum Valerianæ, Infusum Valerianæ Concentratum, Elixir Valerianæ.

Other Preparations.—An ethereal tincture and the volatile oil are official in some of the Continental Pharmacopœias, and a distilled water and syrup in the French Codex. Valerianic acid is not prepared from the root, but synthetically from amyl alcohol.

Note.—Indian Valerian, derived from V. WALLICHII, is official in the Indian and Colonial Addendum for the preparation of an ammoniated tincture, and in composition closely resembles the English drug. *Mexican Valerian*, from V. OFFICINALIS, growing in Mexico, contains more volatile oil than the European root. *Japanese Valerian*, or *Kesso* root, is said to be obtained from a Japanese variety of V. officinalis. The roots of V. PHU and V. DIOICA have similar properties to those of the official drug, and are said to have been found as admixtures with it.

ARNICÆ RHIZOMA.—Arnica Rhizome.—

The dried rhizome and roots of Arnica montana, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 158].

N.O.—Compositæ.

Syn.—Arnicæ Radix.

Habitat.—Middle and Southern Europe.

B.P. Characters.—The rhizome is cylindrical, horizontal, and dark brown in colour. It usually varies from one to two inches (two and a half to five centimetres) in length, and from a sixth to a quarter of an inch (four to six millimetres) in thickness. It is curved, rough, bears amplexicaul leaf-scars, is beset on its under surface with numerous brittle wiry roots, and is usually terminated by the hairy remains of the stem and leaves. The transverse section exhibits a number of resin ducts near the inner margin of the cortex. Odour faintly aromatic, taste acrid and bitter.

Chemistry.—Volatile oil ($\frac{1}{2}$ to 1 per cent.), resin, inulin (10 per cent.), tannin and *arnicin* ($C_{12}H_{22}O_2$). The volatile oil consists of the methyl ether of hydrothymoquinone and the phloryl ester of isobutyric acid. Arnicin, which is said to be the active principle, is a yellow crystalline acrid substance, soluble in alcohol and ether. Starch is absent from the rhizome.

Uses, etc.—Much esteemed domestically as a vulnerary application; internally stimulant and irritant. *Dose.*—5 to 30 grains.

B.P. Preparation.

Tinctura Arnicæ	-	-	1 part in 20 alcohol (20 per cent.)

B.P.C. Preparations.—Extractum Arnicæ Liquidum, Linimentum Arnicæ.

GELSEMII RADIX.—Gelsemium Root.—

The dried rhizome and roots of Gelsemium nitidum, *Michaux* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 181].

N.O.—Loganiaceæ.

Syn.—Yellow Jasmine root.

Habitat.—United States of America.

B.P. Characters.—In nearly cylindrical pieces of about six inches (fifteen centimetres) or more in length, and varying usually from one-quarter to three-quarters of an inch (six to eighteen millimetres) in thickness; occasionally with fibrous roots attached to them. The fracture is splintery; the transverse section exhibits a thin cortex, and a porous yellowish wood which is rendered distinctly radiate by the presence of numerous, conspicuous, straight medullary rays. The rhizome has usually a brown or dark brownish-violet cork often much fissured, is nearly straight, and exhibits silky fibres in the

bast; the root is yellowish-brown, finely wrinkled, and somewhat tortuous. Taste bitter; odour slightly aromatic.

Chemistry.—*Gelsemine* (crystalline alkaloid), *gelseminine* (amorphous alkaloid), *gelsemic* or *gelseminic acid*, volatile oil, resin and starch. Gelsemine is said to be little if at all poisonous, and the activity of the drug is therefore ascribed to the second alkaloid, gelseminine. Gelseminic acid (proved to be identical with *β-methyl-æsculetin*, found in horse-chestnut bark, and in scopola root as scopoletin) is colourless, inodorous, crystalline, and produces a blue fluorescence in alkaline solutions.

Notes.—*Gelsemin* is a precipitated resinoid, and, as such, must be distinguished from the alkaloids mentioned above. Stems may be present as an adulterant of the rhizome, they contain no alkaloid and are distinguishable by their darker colour and slenderness.

Uses, etc.—A powerful spinal sedative. *Dose.*—5 to 30 grains.

B.P. Preparation.

Tinctura Gelsemii - - -	1 part 10 of alcohol (60 per cent.)

B.P.C. Preparations.—Extractum Gelsemii, Extractum Gelsemii Liquidum.

SPIGELIA.—Indian Pink.—The rhizome and roots of Spigelia marilandica, *Linn.* (Carolina Pink).

N.O.—Loganiaceæ.

Habitat.—United States of America.

Characters.—Rhizome two inches or more long, about one-eighth of an inch thick, horizontal, bent, somewhat branched on the upper side with cup-shaped scars; on the lower with numerous thin, brittle roots, about four inches long, dark, purplish-brown; somewhat aromatic; sweetish and bitter taste. The stem is simple erect and quadrangular. Leaves sessile, ovate, lanceolate-acute, decussate. Flowers sessile, in unilateral spikes.

Chemistry.—Fixed and volatile oil, a little resin, bitter extractive, with mucilaginous and saccharine matter and some salts. *Spigeline*, a volatile alkaloid, is also said to be present.

Uses, etc.—Anthelmintic, etc. *Dose.*—15 to 60 grains. Official in U.S.P. for the production of a fluid extract. Spigelia is a frequent ingredient of worm teas and other similar remedies. Its virtues diminish with age.

Note.—Spigelia has been adulterated with the underground portion of Phlox Carolina (also known as *Carolina Pink*), the rootlets of which are brownish yellow, rather coarse, straight, and contain a straw-coloured wood underneath a readily-removable bark: also with the rhizome of a species of Ruellia.

LEPTANDRA.—Leptandra.—The rhizome and roots of Leptandra (Veronica) virginica, *Nutt.*

N.O.—Scrophulariaceæ.

Syn.—Culver's Root.

Habitat.—Canada and United States.

Characters.—Horizontal, from four to six inches long, and about a quarter of an inch thick, somewhat flattened, bent and branched, dark blackish-brown, with cup-shaped scars on the upper side, hard, of a woody fracture, with a thin, blackish bark, a hard, yellowish wood, and a large, purplish-brown, about six-rayed pith; roots thin, wrinkled, very fragile, inodorous, taste bitter, and feebly acrid.

Chemistry.—Tannic acid, gum, resin, trace of volatile oil, and a bitter glucoside, *leptandrin*. The so-called leptandrin of the "eclectics," which is obtained by precipitating the concentrated tincture with water, owes its properties to the presence in it of the above bitter principle.

Uses, etc.—Alterative, cathartic. *Dose.*—15 to 60 grains. Official in the U.S.P. for the production of an extract and a fluid extract.

COLLINSONIA.—Stone Root.—The rhizome and roots of Collinsonia canadensis, *Linn.*

N.O.—Labiatæ.

Syn.—Horse-weed.

Habitat.—North America.

Characters.—Horizontal, about four inches long, and with short, knotty, irregular branches; stem scars numerous, shallow; externally brown-grey, very hard; internally greyish or whitish; bark very thin; wood wedges irregular; roots numerous, rather brittle; nearly inodorous; taste bitterish and nauseous.

Chemistry.—Resin, tannin, starch, mucilage and wax.

Uses, etc —Sedative, antispasmodic, astringent and tonic. *Dose* —10 to 60 grains.

The *B.P.C.* includes a tincture and a fluid extract is also prescribed.

BISTORT.—Bistort.—The dried rhizome of Polygonum Bistorta, *Linn.*

N.O.—Polygonaceæ.

Syn.—Snakewood.

Habitat.—Europe.

Characters.—The rootstock is perennial, woody, tortuous, dark brown externally, reddish within, about the thickness of the finger, and furnished with numerous slender fibres.

Chemistry.—Tannic acid, starch and red colouring matter are present.

Uses, etc.—Tonic, astringent. *Dose.*—8 to 30 grains.

SERPENTARIÆ RHIZOMA—Serpentary Rhizome.—The dried rhizome and roots of Aristolochia Serpentaria, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 246], or of Aristolochia reticulata, *Nutt.*

N.O.—Aristolochiaceæ.

Syn.—Serpentariæ Radix; Virginian Snake Root.

Habitat.—Southern parts of North America.

B.P. Characters.—The rhizome of Aristolochia Serpentaria is tortuous and slender; about one inch (two and a half centimetres) in length, and one-eighth of an inch (three millimetres) in diameter; bears on its upper surface the remains of aerial stems, and on its under surface numerous wiry interlacing roots, often about three inches (seven and a half centimetres) in length. Both rhizome and roots are dull yellowish-brown in colour, have a characteristic camphoraceous odour, and a strong aromatic bitter taste.

The rhizome and roots of Aristolochia reticulata resemble the foregoing, but are longer and thicker, and the roots are straighter than those of Aristolochia Serpentaria.

Chemistry.—Volatile oil (1 to 2 per cent.) *aristolochin* (yellow crystalline bitter), resin, starch, tannin, etc. The volatile oil is a complex body containing a terpene and a borneol ester. The name Aristolochine has also been given to an alkaloid found in another variety of the plant. (*See footnote*).

Uses, etc.—Stimulant, tonic and diaphoretic. *Dose.*—10 to 15 grains.

B.P. Preparations.

Infusum Serpentariæ - - - -	1 in 20.
Liquor Serpentariæ Concentratus -	1 in 2 of alcohol (20 per cent.)
Tinctura Cinchonæ Composita - -	1 in 40.
,, Serpentariæ - - - -	1 in 5 of alcohol (70 per cent.)

Note.—Substitutions and Adulterations.—Care must be taken to distinguish the following:—(1) Valerian, (2) Green Hellebore, and (3) Serpentary Rhizomes. 1.—Is not so long, but much thicker and of a somewhat browner colour, and a marked fœtid odour. 2.—The rootlets are thicker and wrinkled. 3.—Very long brittle rootlets, yellowish; the rootlets have, as seen in transverse section, an eccentric pith in the centre of each; its odour is more camphoraceous and not so strong as Valerian. The rhizomes of Spigelia (darker in colour; pith not eccentric), Hydrastis and Senega have been found mixed with the official drug.

Varieties of Serpentary.—Many species of Serpentaria, besides the official, have been employed in medicine, *e.g.*, A. hirsuta and A. hastata in America, A. cymbifera in Brazil, A. indica in India, etc., the latter being recognised in the Indian and Colonial Addendum as a substitute for Serpentary. A. argentina contains an alkaloid (*aristolochine*), another principle, *aristolin*, a fat (*phytosterin palmitate*) and *aristinic*, *aristidinic*, and *aristolic acids* (Hesse).

ASARUM.—Wild Ginger.—The rhizome of Asarum canadense, *Linn.*

N.O.—Aristolochiaceæ

Syn.—Canada Snakeroot.

Habitat.—North America.

Characters.—Horizontal, four inches or more in length, and about one-eight of an inch in thickness, irregular, quadrangular, finely wrinkled, greyish-brown or purplish brown, internally whitish, fracture short; roots thin; nodes about half an inch apart; aromatic, pungent, bitterish.

Chemistry.—Volatile oil (1½ to 3½ per cent.), resin, *asarin* (bitter principle), mucilage, sugar and alkaloid.

Uses, etc.—Stimulant, carminative, diuretic. Formerly official in the U.S.P.

Note.—Asarabacca (Asarum europœum) has a rhizome very similar to the above; contains volatile oil and has found use as an emetic and cathartic.

KAVÆ RHIZOME.—Kava-kava. The dried decorticated rhizome of Piper methysticum, *Forst.*

N.O.—Piperaceæ.

Habitat.—South Sea Islands.

Characters.—Root large, in commerce usually cut longitudinally and transversely into irregular pieces; light and often more or less hollow in

the interior; externally blackish-grey; fracture farinaceous and somewhat splintery; bark thin; meditullium porous, with irregularly twisted wood bundles radiating near the surface. Odour slight, agreeably aromatic: taste pungent and somewhat benumbing.

Chemistry.—Volatile oil, acrid resins, *kavahin* (crystalline, soluble in water, tasteless), *methysticine* (crystalline, insoluble in water, tasteless), gum, starch, etc. The important constituents are two resins.

Uses, etc.—Said to be much used by the Polynesians as a remedy for gonorrhœa; they also brew from it the beverage *kava*, which has stimulant, diuretic and diaphoretic properties. The rhizome is official in the Indian and Colonial Addendum for the production of a fluid extract. *Dose.*—15 to 60 grains. A non-official alcoholic extract is prepared from it and has been used as a local anæsthetic.

CYPRIPEDIUM. Cypripedium.—The rhizome and roots of Cypripedium hirsutum, *Miller* (C. pubescens), and of Cypripedium parviflorum, *Salis.*

N.O.—Orchidaceæ.

Syns.—Ladies' Slipper; American Valerian.

Habitat.—United States of America.

Characters.—Horizontal, bent, four inches or less long; about one-eight of an inch thick; on the upper side beset with numerous circular, cup-shaped scars; closely covered below with simple wiry roots, varying from four to twenty inches in length; brittle, dark brown or orange-brown; fracture short, white; odour faint, but heavy; taste sweetish bitter and somewhat pungent.

Chemistry.—Volatile oil, a volatile acid, tannic acid, two resins, gum, glucose and starch, are present.

Uses, etc.—Stimulant and anti-spasmodic; official in U.S.P. for the production of a fluid extract. The "eclectic" *cypripedin* is a complex resinoid substance, obtained by precipitating with water a concentrated tincture of the rhizome.

ZINGIBER.—Ginger.—The scraped and dried rhizome of Zingiber officinale, *Roscoe* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 270].

N.O.—Zingiberaceæ (Scitamineæ).

Habitat.—Cultivated in the West Indies, India, Africa, and other countries.

B.P. Characters.—In flattish irregularly branched pieces, varying in length, but commonly from about three to four inches (seven and a half to ten centimetres), each branch marked at the summit by a depressed scar; externally pale buff and somewhat striated and fibrous; breaking readily with a mealy, short, but rather fibrous or sometimes resinous fracture. Odour agreeable, aromatic; taste hot and pungent.

Chemistry.—Volatile oil, which is aromatic and non-pungent ($\frac{1}{4}$ to 1 per cent. or more), the phenolic substance or mixture of substances, *gingerol* (pungent viscid liquid, soluble in

alcohol), resin (3 to 9 per cent. according to the variety), ash (about 4 per cent.)

Note.—Jamaica Ginger contains more of volatile but less of pungent principle than most other gingers.

Uses, etc.—In medicine as a stimulant and carminative. *Dose.*—10 to 20 grains in powder. Ginger is also largely used as a flavouring agent.

B.P. Preparations.

Infusum Sennæ	- - - -	1 in 160.
*Tinctura Zingiberis	- - -	1 in 10 of alcohol (90 per cent.)
Pilula Scillæ Composita.		
Pulvis Cinnamomi Compositus	- -	1 in 3.
,, Jalapæ	,, - -	1 in 15.
,, Opii	,, - -	1 in 3.
,, Rhei	,, - -	1 in 9.
,, Scammonii	,, - -	1 in 8.
Syrupus Zingiberis	,, - -	1 in 40.

**Used in*

Liquor Sennæ Concentratus, Pilula Scammonii Compositus and Acidum Sulphuricum Aromaticum.

The *B.P.C.* includes Oleo-resina Zingiberis (Gingerin) prepared with Acetone, Tinctura Zingiberis fortior, Tablettæ Zingiberis Compositæ, etc. Oleo-resina Zingiberis U.S.P. is an ethereal extract.

Commercial Varieties of Ginger.—The drug is known as *coated* or *uncoated* according to whether or not the epidermal corky layers have been removed; the official ginger belongs to the latter class. The commercial varieties bear the names of the countries from which they are imported.

1. *Jamaica Ginger* (*White Ginger*).—This is uncoated ginger and is naturally pale in colour, but is frequently rendered more white by treatment with lime salts, *e.g.*, chlorinated lime, sulphate, carbonate of calcium, etc. The presence of these salts in excess, since they increase the percentage of ash, renders the powder of such ginger liable to be looked upon as adulterated. Jamaica Ginger yields from 3·7 to 6·9 per cent. to alcohol.

2. *African Ginger* has a light brown coat and a short rhizome. It is extremely pungent and may contain as much as 10 per cent. soluble in alcohol.

3. *Cochin Ginger* is coated, has a short rhizome with depressed lobes, and is red grey in colour, in yield to alcohol it comes between the Jamaica and African varieties.

4. *East India Ginger* is uncoated, and in appearance much resembles the Jamaica variety, but is darker in colour.

Note.—*Green Ginger* is the recently-dug immature undried rhizome. *Preserved Ginger* the same preserved by steeping in hot syrup. *Ratoon* is ginger grown without careful cultivation.

CURCUMA LONGA et ROTUNDA.—Turmeric.—

The rhizomes of Curcuma longa, *Linn*, swollen by steaming or boiling in water and subsequently dried.

N.O.—Zingiberaceæ (Scitamineæ).

Habitat.—East Indies and Cochin China.

Characters.—Occurs in circular (*round turmeric*) or oval (*long turmeric*) pieces, about two inches long and one broad, pointed at one end and marked with annular wrinkles, or somewhat contorted and tuberculated; yellowish externally; internally more or less deep orange-yellow, with a shining, resinous fracture; odour peculiar and aromatic; taste aromatic. When chewed tinges the saliva yellow. The powder is rendered of a brown-red colour by alkalies and soluble borates.

Commercial Varieties:—

1. *Chinese.* Central rhizomes and branches.
2. *Bengal.* Mostly in slender branches of a deep reddish tint.
3. *Madras.* In thick lateral branches, mixed with transversely cut tubers of a gamboge tint.
4. *Java.* Small tubers and branches that are often transversely and longitudinally cut, internally dark.
5. *Cochin China.* Sections or slices of a large tuber, some having the marks of large depressed scars of former stems.

Chemistry.—Volatile oil (1 per cent.), fixed oil, pungent resin, *curcumin* $C_{14}H_{14}O_4$ (an orange yellow, tasteless, resinous principle), starch, mucilage, etc. An alkaloid is also said to be present.

Uses, etc.—As an ingredient of condiments, curries, etc., and for the preparation of test papers (*see characters* above). A tincture is included in the B.P.C.

Note.—Zedoary, the rhizome of Curcuma Zedoaria (*N.O.*—Zingiberaceæ, *Habitat.*—India) has the following characters:—Circular discs of a tuber, one-half to one and one-half inches in diameter; orange-brown, internally pale reddish grey-brown, with numerous brown-yellow resin cells and lighter coloured wood bundles; fracture short, somewhat mealy; odour and taste like those of ginger. It contains volatile oil and resin, and in properties is similar to ginger. Curcuma Starch or East Indian Arrowroot is prepared from the rhizomes of C. angustifolia.

GALANGÆ RHIZOMA.—Galangal.—The rhizome of Alpinia officinarum, *Hance*, yielding Galanga minor, and the rhizome of Alpinia Galanga, *Willd*, yielding Galanga major.

N.O.—Zingiberaceæ (Scitamineæ).

Characters.—Minor or *Smaller.* In cylindrical pieces, often shortly branched, two to three inches long and not thicker than the little finger, slightly wrinkled and annulate, internally orange-brown, darkening on exposure, hard and fibrous, taste and odour pungent, hot and spicy. *Major* and *Larger.*—This variety is infrequently met with in commerce, it resembles the preceding but is larger and its pungency is less pronounced.

Chemistry.—Volatile oil, resin, *galangol* (pungent, inodorous), *kempferid*, *galangin* and *alpinin* (crystalline), starch, etc.

Uses, etc.—Stimulant, aromatic; known and used by the Greeks and Arabians. *Dose.*—5 to 20 grains.

ALETRIS.—Colic Root.—The dried rhizome and roots of Aletris farinosa, *Linn.*

N.O.—Hæmodoraceæ.

Syns.—Star-Grass, Unicorn Root.

Habitat.—United States.

Characters.—A horizontal rhizome, one to two or three inches long, and about one-eighth to two-fifths of an inch thick, pale-brown, flattish or concave on the upper surface, and densely tufted with light grey fibrous or scaly remnants of leaves. The roots are from two to three inches long, wiry, and of a glossy black colour externally, and if more recent, brown. No odour; taste bitter.

Chemistry.—A bitter principle, soluble in diluted spirit, is present, and also much starch.

Uses, etc.—Tonic purgative. *Dose*.—10 grains.

The *B.P.C.* includes a fluid extract and elixir.

Note.—False Unicorn Root is the rhizome of Helonias dioica (*N.O.* Melanthaceæ). It contains the glucoside *Chamælirin*. *Helonin* is an extract of the rhizome.

IRIDIS RHIZOMA.—**Orris Rhizome.**—The rhizome of Iris florentina, *Linn.*, I. germanica, *Linn.*, I. pallida, *Linn.*, etc.; collected in the latter part of the summer, peeled, and dried in the sun.

N.O.—Iridaceæ.

Syn.—Orris root.

Habitat.—Northern Shores of the Mediterranean Sea and other parts of Europe; widely cultivated.

Characters.—Composed of joints which are two to four inches long, the broadest part near the apex about an inch wide, tapering below and abruptly narrowed above to the circular stem-scar, from two sides of which similar joints are produced. Compressed, and when peeled, of a whitish colour externally and internally. The leaf scars are indicated on the upper surface by the transverse lines of vascular bundles, and the roots on the under surface by circular brownish scars, which are more or less crowned near the upper end. Of a firm texture, agreeable violet-like odour, and a mealy bitterish and slightly acrid taste. Of the above varieties, the florentina is preferred for its better colour and appearance and more marked odour.

Chemistry.—Volatile oil, resin, *iridin* (a glucoside), fat, starch, etc. The volatile oil contains *myristic acid* and a ketone having the formula $C_{13}H_{20}O$, to which the name *irone* has been given. Iridin must be distinguished from the resinoid of the same name (*see* Iris Versicolor).

Uses, etc.—Diuretic and cathartic in the fresh state but the dried root is almost exclusively used in perfumery and as a constituent of violet powders, dentifrices, etc. (*e.g.*, Pulvis Violæ B.P.C.) *Dose*.—5 to 15 grains.

Note.—*Oil of orris* (concrete oil), a commercial product, obtained by distilling the root with superheated steam, is a fat, solid at ordinary temperatures owing to the presence of myristic acid.

IRIS VERSICOLOR.—**Blue Flag.**—The rhizome of Iris versicolor, *Linn.*

N.O.—Iridaceæ.

Habitat.—North America.

Characters.—Rhizome horizontal, consisting of internodes two to four inches long; cylindrical in the lower half, flattish, and about four-fifths of an inch broad near the upper extremity, and terminated by a circular scar; annulated from the leaf sheaths, grey-brown in colour; roots long, simple, crowded near the broad end; odour slight; taste acrid, nauseous.

Chemistry.—Acrid resin, fat, sugar, tannin, and, according to some authorities, an alkaloid.

Uses, etc.—Diuretic and purgative. *Dose*.—5 to 15 grains. The substance *iridin*, originally prepared by the "eclectics," and now included in the B.P.C., is an extract of the drug.

The *B.P.C.* also includes Elixir Euonymi Compositum, Liquor Euonymini et Iridini, Liquor Papaini et Iridini.

Note.—IRIS FŒTIDISSIMA, I. PSEUDO-ACORUS, I. TUBEROSA have also been used in medicine.

COLCHICI CORMUS.—Colchicum Corm.—The fresh corm of Colchicum autumnale, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 288], collected in early summer; and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 150° F. (65·5° C.).

N.O.—Liliaceæ (Melanthaceæ).

Syn.—Meadow saffron.

Habitat.—Indigenous.

B.P. Characters.—The fresh corm is about one inch and a half (thirty-five millimetres) long and an inch (twenty-five millimetres) broad, somewhat conical, hollowed on one side where it has a new corm in process of development, and rounded on the other; covered with an outer thin brown membranous coat, and an inner reddish-yellow one; internally white and solid, and when cut yielding a milky juice of a bitter taste and disagreeable odour. Dried slices are one-tenth or one-eighth of an inch (two or three millimetres) thick, yellowish at their circumference, somewhat reniform in outline; firm, whitish, amylaceous; breaking readily with a short fracture; taste bitter; no odour.

Chemistry.—Starch, gum, sugar, resin, fat and the yellow, amorphous alkaloid *colchicine*, 0·5 per cent. (*See* Colchici Semina). The U.S.P. requires the corms to yield not less than 0·35 per cent. of colchicine.

Uses, etc.—Same as the seeds. *Dose.*—2 to 8 grains in powder.

B.P. Preparations.

Extractum Colchici - - -	from expressed juice, yield 4 to 5 per cent.
Vinum Colchici - - - -	1 part of dried corm in 5 of sherry.

B.P.C. Preparations.—Extractum Colchici Aceticum (of the B.P. 1885), Mistura Colchici, etc.

Note.—The young corm of the meadow saffron begins life about June as an offshoot from the old one; late in autumn it sends up the flower, but does not produce leaves till the following spring; the natural order of vegetation and flowering being thus subverted. It is considered to be most valuable in July after the decay of the leaves, it being then about one year old. The plant may be distinguished from any variety of garden saffron (Crocus sativus) by its flower, which has six stamens with extrorse anthers. The Oriental *hermodactyles*, now seldom used, are the dried corms deprived of their outer coats, of probably COLCH. VARIEGATUM. A tincture of Colchicum flowers is included in the B.P.C.

SCILLA.—Squill.—The bulb of Urginea Scilla, *Steinh.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 281]; divested of its dry membranous outer scales, cut into slices, and dried.

N.O.—Liliaceæ.

Habitat.—Coasts of the Mediterranean Sea.

B.P. Characters.—The slices of the inner scales usually present the form of curved strips, frequently tapering towards both ends; they are yellowish-white or somewhat pinkish, from about one to two inches (two and a half to five centimetres) long, somewhat translucent, brittle and easily pulverisable when quite dry, but tough and flexible when moist. Inodorous, disagreeably bitter.

Chemistry.—Much water, gum, sugar, *sinistrin* $C_6H_{10}O_5$ (a peculiar mucilaginous carbohydrate), inorganic salts, including calcium oxalate in the form of *raphides*. Three active glucosidal bitter principles have been described, viz., *scillipicrin*, *scillitoxin*, *scillin*, the two former being probably the more important. The active principles of squill are given up to alcohol, to water, and to acetic acid. Sinistrin is soluble in water, but not in alcohol.

Note.—Squill, especially in powder form is deliquescent and liable to damage by becoming damp, it should be stored in a perfectly dry place.

Uses, etc.—Expectorant and diuretic, etc. *Dose.*—1 to 3 grains in powder.

B.P. Preparations.

Acetum Scillæ - - - - -	1 in 8 of diluted acetic acid.
Oxymel Scillæ.	
Pilula Ipecacuanhæ cum Scilla - -	1 part in 6.
,, Scillæ Composita - - -	1 part in 4.
Syrupus Scillæ *prepared from* Acetum.	
Tinctura Scillæ - - - - -	1 in 5 of alcohol (60 per cent.)

B.P.C. Preparations.—Extractum Scillæ Liquidum, Mistura Scillæ, Linctus Scillæ, etc.

Other Preparations.—The U.S.P. includes a fluid extract which is prepared with an acetic acid menstruum also a compound syrup containing Senega and Tartarated Antimony.

Note 1.—According to Merck, *scillipicrin* is a yellowish-white amorphous powder, having a bitter taste, hygroscopic and very soluble in water; *scillitoxin*, a cinnamon brown powder, insoluble in water and ether, but soluble in alcohol, giving a solution having a lasting, bitter and burning taste, soluble in alkaline solutions; *scillin*, a pale yellow crystalline powder, tasteless, sparingly soluble in water, soluble in alcohol and boiling ether; from the ether it is again precipitated in a crystalline state on cooling.

Note 2.—URGINEA INDICA and SCILLA INDICA (*Indian Squill*) have physical and chemical characters very similar to the official kind. URGINEA, official in the Indian and Colonial Addendum as a substitute for squill is the product of either of these.

VERATRI VIRIDIS RHIZOMA.—Green Hellebore Rhizome.

—The dried rhizome and roots of Veratrum viride, *Aiton.*

N.O.—Liliaceæ.

Syn.—Veratri Viridis Radix.

Habitat.—United States and Canada.

Characters.—Entire, or transversely or longitudinally sliced or divided, and either with or without attached roots. When entire, from one to two inches or more in length, and three-quarters of an inch or more in diameter, erect, obconical, obtuse or truncated at the apex, dark brown externally, whitish within. Frequently bearing at its upper end the

concentrically arranged remains of leaves, and giving off on all sides numerous much-shrivelled yellowish-white roots several inches long; or the latter are detached and mixed with it, in which case the rhizome is marked with corresponding scars. Inodorous, but exciting sneezing when powdered; taste bitterish and very acrid.

Chemistry.—The rhizome contains several alkaloids, the more important of which are *protoveratrine* ($C_{32}H_{51}NO_{11}$), *protoveratridine* ($C_{26}H_{45}NO_9$), *cevadine*, *jervine*, *rubijervine*, and *pseudojervine*. It is probably that protoveratridine is a decomposition product. Protoveratrine is highly poisonous and sneeze-causing. Starch and resin are also present.

Uses, etc.—Emetic, diaphoretic, sedative, highly poisonous. Formerly official for preparing a tincture used as a parasiticide, it is still retained by the U.S.P. and B.P.C.

Note.—This drug, American Green Hellebore, must be distinguished from the rhizome of the European plant, HELLEBORUS VIRIDIS (*N.O.*—Ranunculaceæ), also known as *green hellebore*, which is totally different.

VERATRI ALBI RHIZOMA.—White Hellebore Rhizome.—The rhizome of Veratrum album, *Linn.*

N.O.—Liliaceæ.

Habitat.—Germany.

Characters.—Closely resembles the rhizome of V. viride. In pieces from one to three inches long, one inch or less in diameter, cylindrical, or in the shape of a truncated cone; internally whitish; externally blackish, wrinkled and rough, with the remains of the roots which have been cut off near their origin. Sometimes the roots remain attached to the rhizome. They are numerous, wrinkled, yellowish, and of the size of a crow's quill. When dry, odourless; the taste at first is sweetish, afterwards bitterish, acrid, and burning.

Chemistry.—Almost identical with that of Green Hellebore excepting that *cevadine* is stated to be absent from the white variety.

Uses, etc.—Has similar properties to V. viride; rarely give internally, *Dose.*—1 to 2 grains in powder. The powder has found use in preparing an ointment for itch.

ALLIUM.—Garlic.—The bulb of Allium sativum, *Linn.* (Allium ursinum).

N.O.—Liliaceæ.

Habitat.—Indigenous to Southern Europe.

Characters.—Bulbs, sub-globular, compound, consisting of about eight compressed wedge-shaped bulblets, which are arranged in a circle around the base of the stem, and covered by several dry membranous scales. It has a pungent, disagreeable odour, and a warm aromatic taste. It should be preserved in a dry place and only used in a fresh state.

Chemistry.—Water (50 to 60 per cent.), mucilage (35 per cent.), some protein and about $\frac{1}{4}$ per cent. or less of volatile oil, consisting of organic sulphides of high boiling point (*allyl sulphide* is not present).

Uses, etc.—Stimulant, diuretic, irritant; formerly official in the U.S.P. for the preparation of a syrup.

CONVALLARIA.—Lily of the Valley.—The rhizome and roots of Convallaria majalis, *Linn.*

N.O.—Liliaceæ.

Habitat.—Europe, etc.

Characters.—Creeping, branched, about one-eighth of an inch thick, cylindrical, wrinkled, whitish, internodes 1 to 3 inches in length, marked with a few circular scars, joints annulate and beset with a circle of eight or ten long, branching roots; fracture somewhat tough, fibrous, white; taste sweetish and somewhat acrid; no odour. The whole dried plant has, attached to the rhizomes, two or three elliptic, smooth, radical leaves, subtending a one-sided raceme of thirteen or more nodding, white, bell-shaped, six-lobed flowers.

Chemistry.—Contains two glucosides, *convallarin*, $C_{34}H_{62}O_{11}$ and *convallamarin*, $C_{23}H_{44}O_{12}$.

Uses, etc.—Recommended as a substitute for Digitalis. *Dose.*—1 to 6 grains. The rhizome is official in the U.S.P. for the production of a fluid extract. The B.P.C. prepares a tincture, liquid and solid extract, from the flowers and stalks, and also gives processes for the preparation of the two glucosides.

Note.—POLYGONATUM MULTIFLORUM, *Solomon's seal* (*N.O.*—Liliaceæ. *Habitat.*—Europe), has a rhizome which is horizontal, jointed, white, and marked at short intervals with small circular impressions, which bear a remote resemblance to those made by a seal; inodorous, and of a sweetish, mucilaginous taste, followed by a slight degree of bitterness and acridity. It contains convallarin, asparagin, sugar, etc.

POLYGONATUM BIFLORUM, *American Solomon's seal*, has characters and constitution similar to the European drug. SMILACINA RACEMOSA is known as *false Solomon's seal*.

CALAMUS.—Sweet Flag.

—The rhizome of Acorus calamus, *Linn.*

N.O.—Aroidaceæ.

Habitat.—Europe and North America.

Characters.—In sections of various lengths, unpeeled, about three-quarters of an inch broad, subcylindrical, longitudinally wrinkled; on the lower surface marked with the circular scars of the roots in wavy lines; externally reddish-brown, somewhat annulate from remnants of leaf-sheaths; internally whitish, of a spongy texture, breaking with a short, corky fracture, showing numerous oil-cells and scattered vascular bundles, the latter crowded within the subcircular stelar tissue. It has an aromatic odour and a strongly pungent taste.

Chemistry.—A bitter glucosidal principle, *acorin* (0·2 per cent.), alkaloidal matter mainly choline, volatile oil (1·5 to 3·5 per cent.), and resin (3 per cent.). Acorin yields oil of calamus and sugar on hydrolysis and *acoretin* (a neutral resin) on oxidation.

Uses, etc.—Stimulant, carminative. *Dose.*—10 to 60 grains. Official in the U.S.P. for the production of a fluid extract.

TRITICUM.—Couch Grass.

—The rhizome of Agropyrum (Triticum) repens, *Beauvois.*, gathered in the spring and deprived of its roots.

N.O.—Graminaceæ.

Syn.—Radix graminis, quitch grass, etc.

Habitat.—Europe.

Characters.—Very long, but, as met with in the pharmacies, cut into sections about two-fifths of an inch long, and about one-twelfth of an inch thick; creeping, smooth, hollow in the centre, straw-yellow, inodorous, and of a sweet taste.

Chemistry.—*Triticin*, $C_{12}H_{22}O_4$ (tasteless amorphous), and sugars; ash 4 to 5 per cent.

Uses, etc.—Diuretic and nutrient. *Dose.*—In decoction *ad libitum*. Official in the Indian and Colonial Addendum for the production of Decoctum Agropyri and Extractum Agropyri liquidum.

4. WOODS.—LIGNA.

Histology, etc., of Woods.—The woods which are made use of in medicine consist in the majority of cases of that portion of the trunk of dicotyledonous trees which is known as the *heart-wood* or *duramen*. A transverse section of the trunk of a full-grown tree shows a dark speck, the *pith*, surrounded by a huge mass of wood bounded externally by the cambium cylinder which is itself enclosed by the several-layered bark. The woody substance is divided up into wedges of varying thickness by plates of tissue passing through it at intervals and appearing in transverse sections as lines radiating from the centre to the circumference; these radial plates of tissue are the *medullary rays*, and, like the wood, have been developed by the activity of the cambium cylinder.

The wood proper or *xylem* is made up of *wood vessels*, *tracheids*, *wood fibres*, and *wood cells*. The vessels or *tracheæ* consist of elongated communicating segments placed vertically end to end, the walls of which show various local thickenings in the form of rings, pits, etc.; the varying nature of these thickenings gives rise to the terms *annular*, *spiral*, *reticulate*, *pitted*, etc., vessels, while the calibre of the vessels varies, spiral vessels being relatively narrow, pitted vessels wide. The wood fibres are long cells with pointed ends and thick walls, occasionally bearing slit-like markings, and thus differing from the tracheids which are similar fibres having bordered pits. The cells of the wood consist of vertical groups of short parenchymatous cells, each having pitted walls and the fusiform shape of a tracheid, and during the winter period of rest these cells are loaded with starch grains. The medullary rays are made up of parenchymatous cells, in single, double, or broader rows, arranged radially. The so-called *annual rings* which are observed on examining a section of wood taken at right angles to the direction of its growth are produced by the contrast between the calibres of the wood elements formed in the spring and autumn respectively, the former being for physiological reasons wider than the latter.

At a certain period in the life of a tree the change from *sapwood* or *alburnum* to *heartwood* or *duramen* takes place; this is brought about by the physiological death of the tissues concerned, and the infiltration of various chemical substances, gum, resins, colouring matters, etc., into the cells and cell walls. Except for its resistent and mechanical qualities the duramen no longer takes a part in the life-processes of the tree.

General Chemical Properties of Wood.—The substances which render woods valuable in medicine and the arts are in the majority of cases the *resins*, *volatile oils*, and other principles, by the infiltration of which the

conversion of sapwood into heartwood takes place. The remaining substance of the woods consists of carbohydrates (*lignin, wood gum*), various inorganic salts, etc.

TINOSPORA.—Gulancha.—The stems of Tinospora cordifolia, *Miers.*

N.O.—Menispermaceæ.

Habitat.—Tropical India.

Characters.—Dried transverse segments of a cylindrical woody stem, varying in diameter from a quarter to two inches, and from one-half to two inches in length; of a shrunken appearance, and covered with a smooth translucent shrivelled bark, which becomes dull and rugose with age. Many of the pieces are marked on their surface with warty prominences. A transverse section shows a radiate structure, with conspicuous medullary rays, transversing a very porous tissue. It is inodorous, but has a very bitter taste. Its infusion is not blackened by a persalt of iron.

Chemistry.—Its activity is due to the presence of *berberine* and a bitter glucosidal principle.

Uses, etc.—Gulancha is recognised by the Indian and Colonial Addendum as a substitute for Calumba.

GUAIACI LIGNUM.—Guaiacum Wood.—

The heart-wood of Guaiacum officinale, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 41], or of Guaiacum sanctum, *Linn.* [*Sargent, Silva*, vol. i. plate 28].

N.O.—Zygophyllaceæ.

Syn.—Lignum Vitæ.

Habitat.—San Domingo and Jamaica.

B.P. Characters and Tests.—Guaiacum Wood is dark greenish-brown in colour, dense, hard, and heavier than water. Its taste when chewed is acrid, and when heated its odour is somewhat aromatic. The alcoholic tincture assumes a blue colour on the addition of diluted *test-solution of ferric chloride*.

Chemistry.—Resin 20 to 25 per cent. or less (*see* Guaiaci resina); extractive 3 to 4 per cent.; ash 6 per cent.

Uses, etc.—The wood enters into the official compound decoction of sarsaparilla; its chief use, however, is for the purposes of the turner.

B.P. Preparations.

Guaiaci Resina.

Liquor Sarsæ Compositus Concentratus - 1 part in 10 of alcohol (about 20 per cent).

Note.—When in chips, Guaiacum wood often presents a mixed appearance, because the sapwood or alburnum, the newer and softer portion of the stem, has a pale yellow colour (it is also tasteless), while the duramen or heartwood, which alone is official, is dense and of a dark greenish-brown colour; the latter has a S.G. of 1·3, and by contact with nitric acid becomes greenish. A microscopic examination shows the wood to be chiefly made up of ligneous cells filled with resin.

QUASSIÆ LIGNUM.—Quassia Wood.—

The wood of the trunk and branches of Picræna excelsa, *Lindl.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 57].

N.O.—Simarubaceæ.

Syn.—Bitter Wood.

Habitat.—Jamaica.

B.P. Characters.—Quassia wood is imported in logs of varying length, frequently exceeding six inches (fifteen centimetres) in diameter. The wood is yellowish-white, tough and dense, but easily split. The longitudinal section exhibits elongated cells containing single crystals of calcium oxalate. The transverse section exhibits medullary rays, mostly two or three cells in width. The wood is inodorous, but has an intense, purely bitter, taste.

Chemistry.—The bitterness of the wood is due to the presence of *picrasmin*, a crystalline bitter substance, soluble in alcohol and water, converted into *picrasmic acid* by the action of hydrochloric acid, and regarded as being a mixture of two varieties, α-picrasmin ($C_{35}H_{46}O_{10}$) and β-picrasmin ($C_{36}H_{48}O_{10}$) of differing melting points. Tannin is absent.

Uses, etc.—As tonic and stomachic. Bitter cups are turned from the wood, and non-poisonous fly papers and horticultural insecticides are prepared from an aqueous extract.

B.P. Preparations.

Infusum Quassiæ - - - -	about 1 in 100.
Liquor Quassiæ Concentratus - -	1 in 10.
Tinctura Quassiæ - - - -	1 in 10 of alcohol (45 per cent.)

B.P.C. Preparations.—Extractum Quassiæ, Infusum Quassiæ Concentratum.

Note.—The wood of Quassia (Simaruba) amara (*Surinam quassia*) was formerly official as a source of quassia. It is denser than that of Picræna excelsa, and the medullary rays are usually only one cell in thickness. It contains *Quassiin*, a mixture of bitter principles closely resembling yet distinct from the picrasmin of the official species.

HÆMATOXYLI LIGNUM.—Logwood.—

The heartwood of Hæmatoxylon campechianum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 86].

N.O.—Leguminosæ.

Habitat.—Campeachy, Honduras, and Jamaica.

B.P. Characters.—The wood is hard, heavy, dull orange to purplish-red externally, and internally reddish-brown. The chips or coarse powder, which should be unfermented, have a slight and somewhat agreeable odour, and a sweetish astringent taste. When chewed it colours the saliva pink.

Chemistry.— The essential constituent is *hæmatoxylin* $C_{16}H_{14}O_6$ (9 to 12 per cent.). When pure it is in colourless crystals, but

on exposure to air (oxygen) and alkalies (ammonia) it becomes coloured, owing to the production of *hæmatein*, a dark violet-coloured substance, which again may be reduced to hæmatoxylin by the action of nascent hydrogen, sulphurous acid, etc. *Quercetin*, tannin, etc., are also present.

Uses, etc.—In medicine as a mild astringent; in the arts as a dye, ingredient of inks, etc.

B.P. Preparation.

Decoctum Hæmatoxyli - - - - 1 part in 20

B.P.C. Preparations.—Extractum Hæmatoxyli, Extractum Hæmatoxyli Liquidum.

Note.—A microscopic examination of logwood shows the colouring matter to reside chiefly in the walls of the ligneous tissue. The wood gives 3 per cent. of ash and yields a good charcoal for medicinal use. The logs have a S.G. of 1·057. The chips are often marked with patches of a greenish hue, due to the formation of hæmatein as a result of fermentation. The aqueous extract, which is evaporated to dryness because there is nothing of an adhesive nature present in the wood, has been mistaken for kino, but it is less astringent and of a sweetish taste; it is official in the U.S.P.

Brazil wood [CÆSALPINIA (species variæ). *N.O.*—Leguminosæ. *Habitat.*—Brazil.] may be distinguished from logwood by the fact that its colouring matter *brazilin* ($C_{16}H_{14}O_5$), forms a red solution with the alkalies, whereas, with logwood infusion, a purple colour results. Formerly used in medicine, etc., it now finds application only as a dye.

Sappan, the heartwood of Cæsalpinia Sappan, is official in the Indian and Colonial Addendum as an equivalent of logwood, and contains an active principle closely resembling hæmatoxylin and brazilin.

PTEROCARPI LIGNUM.—Red Sandal-wood.

—The heartwood of Pterocarpus santalinus, *Linn. f.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 82].

N.O.—Leguminosæ.

Syns.—Red Sanders Wood; Santalum rubrum.

Habitat.—Ceylon and Malabar.

B.P. Characters.—Red Sanders Wood is imported in large heavy logs, bark reddish-brown or blackish-brown externally, and internally, if cut transversely, deep blood-red, variegated with zones of a lighter colour. It has a very slight astringent taste, and, when warmed, exhales a faint aroma. The colouring matter is soluble in *alcohol* (90 per cent.), but only sparingly soluble in *water*. The wood usually occurs in commerce in the form of blood-red or red-brown raspings.

Chemistry.—*Santalin* or *santalic acid* ($C_{15}H_{14}O_5$), a crystalline red-coloured body, soluble in alcohol (red colour), ether, and alkalies (violet colour), insoluble in water. Three other crystalline principles, viz., *santal*, *pterocarpin*, *homo-pterocarpin* have also been described as being present in the wood.

Uses, etc.—Valueless as a medicine; used in pharmacy for colouring tinctures, and in the arts as a dye.

B.P. Preparation.

Tinctura Lavandulæ Composita.

Note.—Barwood is the wood of PTEROCARPUS ANGOLENSIS, and is imported from West Africa. *Camwood*, said to be derived from BAPHIA NITIDA, is likewise obtained from the west coast of Africa, *e.g.*, Gaboon, etc.

The colouring principles of the above dyewoods, and of Sanders Wood, are nearly allied if not identical.

Fustic is a yellow dyewood obtained from MORUS TINCTORIA (CHLOROPHORA TINCTORIA), a tree of *N.O.*—Moraceæ (West Indies and South America). It is used as a dye, and contains two coloriferous principles, *morin* (*morindon*) and *moritannic acid*. The first-named has the constitution of a trioxymethylanthraquinone, $C_{15}H_7O_2(OH)_3$ (compare *emodin*, under Rhei Radix). Another fustic, distinguished as *new fustic*, *Hungarian fustic*, and derived from RHUS COTINUS (*N.O.*—Anacardiaceæ), contains a colouring principle, *fisetin* ($C_{15}H_{10}O_6$), having the constitution of a tetroxymethylanthraquinone.

SANTALUM ALBUM.—Sandalwood.—The heartwood of Santalum album, *Linn.*

N.O.—Santalaceæ.

Habitat.—Southern India.

Characters.—In billets four feet in length, and varying in diameter; colour from whitish to brownish-yellow, those of a deeper colour being more highly valued than the paler varieties. The wood is hard and heavy, when cut transversely it has a somewhat waxy lustre and exhibits irregular concentric zones, alternately lighter and darker in colour, sometimes rather indistinct, with very fine vessels and delicate medullary rays. When rubbed or rasped it has an agreeable, aromatic, somewhat roseate odour; its taste is bitterish, aromatic, and slightly acrid.

Chemistry.—The valuable constituent of the wood is the essential oil, the yield of which (*see* Oleum Santali) varies according to the quality of wood; the best kinds give about 3 to 5 per cent.

Uses, etc.—The wood is used as a source of the oil; is also made into fancy articles, and used as an ingredient of incenses. In India it figures in burial rites.

Note.—VARIETIES OF SANDALWOOD.—*Indian Sandalwood*, which is the officially-named source for the oil, is a Government monopoly. When the trees die the sapwood and smaller branches are removed, and they are then cut up into logs or billets. The billets are arranged in classes according to their relative value; those from the large roots being regarded as most valuable, the so-called *jajpokal* (hollow), *bagaradad* (branches), and *Besola bukni* (chips with sapwood) ranking last.

Other varieties of Sandalwood are obtained from the Sandwich Islands (source—S. FREYCINETIANUM); from the Fiji Islands (source—S. YASI); from Western Australia (source—FUSANUS SPICATUS); from New Caledonia (source—S. AUSTRO-CALEDONICUM).

5. LEAVES.—FOLIA.

The perfect leaf consists of three parts, viz., the *blade* or *lamina*, the *stalk* or *petiole*, and the *stipules*. The two latter are often wanting, and a leaf having no stalk is said to be sessile, if without stipules, exstipulate. By DURATION leaves are *deciduous*, *i.e.*, lasting for a single season, or *persistent*, in which latter case the leaves when they fall are replaced by others, thus rendering the plant evergreen. The VEINING or VENATION of leaves is of two kinds, viz., *parallel-veined* (Monocotyledons), reticulate or *netted-veined* (Dicotyledons). Parallel-veined leaves may have the veins arranged longitudinally, transversely, or radiately (palms), while the veins of netted veined-leaves may be arranged either pinnately (senna) or palmately (aconite). Leaves are either *simple*, *i.e.*, one on each leaf-stalk, or *compound*, when each leaf-stalk has two or more leaflets.

The general OUTLINE or CIRCUMSCRIPTION of leaves takes various forms, *e.g.*, *linear* (rosemary); *lanceolate* (senna); *ovate* (belladonna); *orbicular* (mallow); *cuneate* (Barosma betulina); *spathulate* (bearberry); *cordate* (coltsfoot); *reniform* (hepatica); *auriculate* (woody nightshade); *sagittate* (convolvulus); *hastate* (arum maculatum); *peltate*, etc.

The APEX of the leaf may be pointed or blunt, the different forms met with being described by such terms as—*acuminate* (stramonium); *acute* (Indian senna); *obtuse* (bearberry); *truncate* (Barosma serratifolia); *retuse* (Barosma betulina); *emarginate* (jaborandi), etc.

The MARGIN of the leaf may be entire (jaborandi, eucalyptus, etc.) or cut, or divided in various ways. When the margin is cut it may be *serrate* (Barosma serratifolia); *crenate* (digitalis); *undulate* (hamamelis); *sinuate* (stramonium); *incised* (aconite); *spiny* (holly); *crisped* (parsley), etc.

Frequently the margin of a leaf is deeply segmented and it is said to be divided, parted, cleft, or lobed, according to the depth or extent of the segmentations. These divisions, parts, clefts, and lobes are said to be pinnate or palmate, according to the disposal of the segments; similarly, compound leaves are said to be either pinnately or palmately compound, according to the disposal and number of the leaflets.

In TEXTURE, leaves may be coriaceous or leathery, but more commonly they are thin and fragile, and when dry, papery. Hairs are frequently present, more especially on the under sides of leaves, and these are not uncommonly of a glandular nature. The presence of oil glands, frequently in the form of short cavities lying immediately under the epidermis (Rutaceæ), is a common feature of the medicinal leaves.

General Chemistry of Leaves.—Besides protein, carbohydrates, chlorophyll, wax, inorganic salts, etc., the medicinal leaves contain various other bodies, those most frequently met with being perhaps tannin and some kind of volatile oil. Other active substances found are alkaloids, resins, glucosides, bitter principles, etc. The amount of mineral matter present is frequently large, amounting in some cases to as much as 16 or 17 per cent.

ACONITI FOLIA.—Aconite Leaves.—The fresh leaves and flowering tops of Aconitum Napellus, *Linn.*, gathered, when about one-third of the flowers are expanded, from plants cultivated in Britain.

N.O.—Ranunculaceæ.

Syn.—Monkshood, wolfsbane.

Habitat.—Britain.

Characters.—Leaves alternate, with long channelled stalks, very deeply cut palmately into five or three segments, which are again deeply and irregularly divided into oblong acute narrow lobes; exciting slowly, when chewed, a sensation of tingling and numbness. Flowers large, irregular, deep blue, in a somewhat loose terminal raceme.

Chemistry.—Alkaloid about 0·3 per cent. of the dried leaf (*s e* Aconiti radix).

Uses, etc.—As Aconite root. *Dose.*—1 to 2 grains in powder.

Preparations.—The 1885 B.P. included Aconite leaf and a green extract made from the expressed juice, which is retained in the B.P.C.

Note.—The dried leaves when met with, usually consist of small fragments of the channelled leaf segments, and the conspicuous blue flowers are often also present. From the dried leaves, extracts both aqueous and alcoholic are included in some of the Continental Pharmacopœias.

HEPATICA.—Liverwort.—The leaves of Anemone Hepatica, *Linn.*

N.O.—Ranunculaceæ.

Habitat.—North America and Europe.

Characters.—Broad kidney-heart-shaped, about two inches long and broad, long petiolate, three-lobed, the lobes obtuse or acute; slightly leathery; smooth and dark-green above; inodorous, insipid, slightly astringent, slightly bitterish.

Chemistry.—Mucilage, sugar, tannin, etc.

Uses, etc.—Demulcent, tonic. *Dose.*—30 to 120 grains in decoction, etc.

VIOLÆ FOLIA.—Violet Leaves.—The leaves of Viola odorata, *Linn.*

N.O.—Violaceæ.

Syn.—Sweet Violet.

Habitat.—Europe (cultivated).

Characters.—Leaves reniform or cordate with crenate margins.

Chemistry.—A glucoside, probably *Viola-quercitrin*, is present together with salicylic acid.

Uses, etc.—Internally and externally, in the form of infusion of the fresh leaves, as a reputed cure in cancer.

Note.—The petals are used in the preparation of Syrup. Violæ B.P.C.

THEÆ FOLIA.—Tea Leaves.—The specially prepared leaves of Camellia Thea, *Link.* (Thea Sinensis).

N.O.—Ternstrœmiaceæ.

Habitat.—China; cultivated in India, etc.

Characters.—Occur in commerce as little cylinders or rolls, into which the leaves have been twisted during the manipulation of rolling. After maceration and unfolding the perfect leaves will be found to be from one to two inches long; oval, obovate, or oblanceolate in shape; shortly petiolate, pointed at both ends, or blunt, sometimes emarginate at apex, and irregularly toothed at the margin. They have a prominent midrib, with the lateral branches curved upwards and anastomosing near the margin. The colour is sometimes heightened by means of "facings" of Prussian blue, gypsum, or plumbago, and an artificial odour is said to be imparted to the leaves by the admixture of various aromatic flowers which are subsequently removed.

Chemistry.—Tannin (10 to 20 per cent. gallo-tannic acid), *boheic acid*, volatile oil, aqueous extract (about 50 per cent.), protein, wax, resin, ash (4 to 6 per cent.), and *thëine* or caffeine ($2\frac{1}{2}$ to 4 per cent.). A second alkaloid, *theophylline*, has been described as occuring with caffeine in tea.

CAFFEINA, P.B. [THEINA, GUARANINA] (trimethyl-xanthine, $C_8H_{10}N_4O_2,H_2O$), may be prepared from tea in various ways.—1. By removing astringent and colouring matters from the infusion by means of lead acetate, removing the excess of lead with hydrogen sulphide, evaporating and crystallizing; 2. by treating a mixture of tea dust and lime or magnesia with boiling chloroform; it may also be obtained by sublimation. It occurs in fine interwoven needles, crystallising with one molecule (8·49 per cent.) of water which it loses at 100° C.; on heating to 178° C., the anhydrous alkaloid melts and volatilizes without decomposition if the heat be continued. It is soluble in 68 parts of water, in 40 of rectified spirit, in 7 of chloroform, and readily in boiling water. It gives a precipitate with tannic acid which is soluble in an excess of the reagent. Treated with potassium chlorate and hydrochloric acid, and the mixture evaporated to dryness in a porcelain dish, a reddish residue results which becomes purple when moistened with solution of ammonia. It is a valuable cardiac tonic and diuretic. *Dose.*—1 to 5 grains. From caffeine the official CAFFEINÆ CITRAS is prepared, and from it an effervescent salt; other salts used in medicine are the hydrobromide, hydriodide, sodio-salicylate, valerianate, etc.

Note.—African Tea, Abyssinian Tea (*Khat, Cafta, Tohat, Gat, etc.*) is derived from CATHA EDULIS. (*N.O.*—Celastraceæ. *Habitat.*—North East Africa). It is chewed by the Arabs, who also make a decoction of it which they use as a beverage. The leaves contain a non-volatile alkaloid *katrine*, resembling cocaine.

COCÆ FOLIA.—Coca Leaves.—The dried leaves of Erythroxylum Coca, *Lam.*, and its varieties [*Bot. Mag.* plate 7334; *Pharm. Journ.* ser. 3, vol. xxii. p. 818, plates].

N.O.—Linaceæ.

Syn.—Cuca.

Habitat.—Bolivia and Peru (cultivated in Ceylon and Java).

B.P. Characters.—The leaves imported from Bolivia vary usually from one and a half to three inches (three and a half to seven centimetres) in length and from one to one and a half inches (twenty-five to thirty-five millimetres) in breadth. They are brownish-green in colour, oval, entire and glabrous, the upper surface bearing a distinct ridge above the midrib. On the under surface near to the midrib and on either side of it a curved line is almost always distinctly visible. The midrib itself is prolonged into a minute horny apiculus, which, however, is frequently broken off. Most of the epidermal cells of the under surface are seen in transverse section to project in the form of small papillæ. The leaves possess a faint but characteristic odour and a slightly bitter taste which is succeeded by a sensation of numbness. They should be free from mildew.

The leaves imported from Peru are somewhat smaller, narrower, and more fragile than those imported from Bolivia; they are pale green in colour, and do not exhibit a prominent ridge above the midrib on the upper surface, nor such distinct curved lines on either side of it on the under surface.

Coca leaves deteriorate somewhat rapidly especially in a damp atmosphere, the leaves becoming dull-brown with considerable diminution in the amount of alkaloidal content. It is for this reason that the alkaloid is usually roughly separated in S. America and imported into this country as crude cocaine.

Chemistry.—Coca contains the alkaloids *cocaine* (formerly called *erythroxyline*) 0·4 to 0·8 per cent., *cinnamyl-cocaine*, and *truxilline (cocamine, isotropyl cocaine).* Cocaine is present in largest quantity in Bolivian (Huanhuco) Coca, while the two latter alkaloids form a large proportion of the total alkaloid of the Peruvian (Truxillo) variety. *Hygrine*, an oily volatile body, has also been described as being present in the leaves, but it is a question whether or not it is a decomposition product obtained in the assay. Java Coca, and to some extent the other varieties, also contain yet another alkaloid which has been called *tropacocaine* (benzoyl pseudotropeine). A tannin (*cocatannic acid*) and wax are also present in all the varieties. The U.S.P. requires Coca leaves to yield not less than 0·5 per cent. of ether soluble alkaloid.

Uses, etc.—As stimulant, diaphoretic, and restorative. *Dose.*—15 to 60 grains. It is highly valued as a sustenant by the natives of Peru and Bolivia, by whom it is mixed with lime or a special plant ash, and chewed.

B.P. Preparations.

*Cocaina.

†Cocainæ Hydrochloridum.

Extractum Cocæ Liquidum - - - 1 part in 1.

**Used in preparing*

Unguentum Cocainæ - - - - 1 part in 25.

†*Used in preparing*

Injectio Cocainæ Hypodermica - - 1 part in 10.

Lamellæ Cocainæ - - - - containing $\frac{1}{50}$ grain in each disc.

Trochiscus Krameriæ et Cocainæ - - containing $\frac{1}{20}$ grain in each lozenge.

B.P.C. Preparations.—Extractum Cocæ Liquidum Miscibile, Tinctura Cocæ, Vinum Cocæ, Elixir Cocæ.

Cocainæ Hydrochloridum P.B. ($C_{17}H_{21}NO_4$,HCl) may be obtained by neutralising the alkaloid with hydrochloric acid and crystallizing from alcohol. The salt occurs in colourless acicular crystals or crystalline powder. It melts at 356° to 366·8 F. (180° to 186° C.). Soluble in half its weight of cold water, forming a clear and colourless solution, neutral to litmus, and in four times its weight of alcohol (90 per cent.) or of glycerin. It is soluble in olive oil and almost insoluble in ether. Its aqueous solution has a bitter taste, produces on the tongue a tingling sensation followed by numbness, and when applied to the eye dilates the pupil. It affords a yellow precipitate with solution of auric chloride; a white precipitate with solution of ammonium carbonate, and also with solution of borax. It dissolves without colour in cold sulphuric or nitric acid, but chars with hot sulphuric acid, evolving an agreeable odour, and yielding a crystalline sublimate of benzoic acid. Its aqueous solution yields with solution of potassium hydroxide a white precipitate soluble in alcohol or ether, with solution of picric acid a yellow precipitate becoming crystalline on standing, with test-solution of mercuric chloride slightly acidulated with hydrochloric acid, a white precipitate soluble in hot water. Moistened with nitric acid the mixture evaporated to dryness, and a drop of alcoholic solution of potassium hydroxide added, a characteristic odour is evolved more or less recalling that of peppermint. A solution containing not less than 1 per cent. gives with excess of solution of potassium permanganate a copious red precipitate which does not change colour within an hour (absence of cinnamyl cocaine and cocamine or other products derived from cocaine.) 0·1 gramme dissolved in 100 cubic centimetres of water and 0·25 cubic centimetres of solution of ammonia added, affords a clear solution, from which a crystalline deposit should gradually separate on stirring (limit of amorphous alkaloid). It affords the reactions characteristic of hydrochlorides. It should not afford more than the slightest reactions with the tests for sulphates. Dried for twenty minutes at 204° to 212° F. (95·6° to 100° C.) it should not lose more than 1 per cent. of moisture. Heated to redness with free access of air it burns without residue. *Dose.*—$\frac{1}{5}$ to $\frac{1}{2}$ grain.

Cocaina P.B. ($C_{17}H_{21}NO_4$) occurs in colourless, transparent prisms, soluble in 700 parts of water, freely soluble in ether, soluble in 12 parts of olive oil. Melting point 96° to 98° C. On heating with hydrochloric acid it breaks up into methyl-alcohol, benzoic acid and *ecgonine* ($C_9H_{15}NO_3$), and it is thus shown to be the methyl-ester of benzoyl-ecgonine. Ecgonine, which is the basis of all the Coca alkaloids, and is itself probably present in the leaves, is a derivative of tetrahydropyridine, and since tropine, a

decomposition product of atropine, is regarded as being a tetrahydropyridine, a well-defined chemical relationship between cocaine and atropine is thus established. Cocaine may be prepared by exhausting the leaves with dilute sulphuric acid, the acid liquid is then agitated with excess of sodium carbonate and kerosene, the latter taking up the alkaloid. This kerosene solution is then repeatedly extracted with dilute acid, the acid liquor again rendered alkaline with sodium carbonate and the liberated alkaloid taken up with ether. After removing the ether, the crude alkaloid is dissolved in dilute acid, decolourized by animal charcoal and after reprecipitation with sodium carbonate, dissolved in alcohol and crystallized.

Note.—ADULTERATION. Coca leaves have been found containing a considerable proportion of small jaborandi leaves.

B.P.C. Preparations of Cocaine.—Cereoli Cocainæ, Chloral Camphoratum cum Cocaina, Oleinatum Cocainæ.

BUCHU FOLIA.—Buchu Leaves.—The dried leaves of Barosma betulina, *Bart. and Wendl.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 45].

N.O.—Rutaceæ.

Syns.—Diosma leaves, Short Buchu leaves.

Habitat.—Cape of Good Hope.

B.P. Characters.—Usually varying in length from half to three-quarters of an inch (twelve to twenty millimetres), dull yellowish-green in colour, rhomboid-obovate in outline, rigid, and, when slightly moist, mucilaginous. The surface is glabrous and somewhat warty, the margin usually sharply denticulate, the apex blunt and recurved. Oil glands are distinctly visible in the leaf, especially near the margin. The transverse section exhibits an epidermis whose cells are thick and rich in mucilage. Odour and taste strong and characteristic.

Chemistry.—The leaves contain *volatile oil* (1·5 per cent.) *hesperidin*, and a peculiar bitter principle called *barosmin* or *diosmin* has also been described. The other constituents are resinous, gummy, albuminous, and colouring matters and salts. The ash amounts to 4 to 5 per cent., and contains a notable quantity of manganese. By exposing the volatile oil of Buchu to a low temperature, *barosma-camphor* (*diosphenol*), a stearoptene, fusing at 85° C., crystallises out.

Uses, etc.—As tonic, diaphoretic, and diuretic, given chiefly in urinary diseases. *Dose.*—20 to 30 grains in powder.

B.P. Preparations.

Infusum Buchu	-	1 part in 20.	
Tinctura ,,	-	1 ,,	5 of alcohol (60 per cent.)

B.P.C. Preparations.—Extractum Buchu Liquidum, Infusum Buchu Concentratum, Mistura Buchu Comp., etc.

Note.—The leaves of BAROSMA CRENULATA and of BAROSMA SERRATIFOLIA (*long Buchu*) were official in the 1885 Pharmacopœia, but these have now been omitted, owing to the smaller amount of the substance diosphenol present in them. B. crenulata leaves are from three-quarters to about an inch and a quarter long, thickish, oval-oblong, or rhomboid-oval, somewhat blunt at the apex, narrowed at the base into a distinct petiole, finely serrate or crenate-serrate. The leaves of B. serratifolia on the other hand are from an inch to an inch and a half long, linear-lanceolate, equally tapering to each end, actual

apex truncate, sharply and closely serrate; texture thinner than in the other species. The short Buchu is sometimes mixed with the flowers and non-aromatic capsules of the plant. The long Buchu is usually free from these, but the leaves of EMPLEURUM SERRULATUM, a Rutaceous plant growing in the same districts as Buchu, are occasionally present in very large proportions. The characters of these leaves are from one to three inches long, having a narrow linear shape, a serrulated margin, and an acute apex, without any oil duct. The leaves of BAROSMA PULCHELLA have lately appeared on the market, in general appearance they resemble B. betulina, but are ovate in shape and possess a strong odour recalling citronella. *Karoo Buchu* leaves from Diosma succulenta are smaller than the official variety with entire margins, they yield an oil containing diosphenol. *Aniseed Buchu* of undetermined source is ovate-lanceolate with a prominent midrib and possessing a strong anise-like odour.

JABORANDI FOLIA.—Jaborandi Leaves.

—The dried leaflets of Pilocarpus Jaborandi, *Holmes*, [*Bot. Mag.* plate 7483, and *Pharm. Journ.* ser. 3, vol. v. p. 582],

N.O.—Rutaceæ.

Habitat.—Pernambuco (South America).

B.P. Characters.—Jaborandi leaflets are dull green in colour, oval-oblong or oblong-lanceolate in outline, and usually vary from two and a half to four inches (six to ten centimetres) in length. They are shortly petiolate, obtuse and emarginate at the apex and, for the most part, unequal at the base; the margin is entire and slightly revolute, the texture coriaceous. The mature leaflets are glabrous, or exhibit at most a few scattered hairs on the under surface; on the upper surface the lateral veinlets are distinctly prominent. The mesophyll contains numerous oil-glands readily visible by transmitted light. They emit when bruised a slight aromatic odour; the taste is at first somewhat bitter and aromatic, becoming afterwards pungent. When chewed they increase the flow of saliva.

Note.—VARIETIES OF JABORANDI.—It has been shown by Holmes that Pernambuco jaborandi is the product of *Pilocarpus Jaborandi*; the leaflets of *P. pennatifolius* (*Paraguay jaborandi*) are usually obovate-lanceolate rather than oblong, of a thinner and more paper-like consistence, of a grey-green hue, and are similarly furnished with oil glands. The official variety is now rarely met with in commerce, P. pennatifolius being usually substituted, the latter is however frequently very low in alkaloidal strength, 0·07 to 0·3 per cent. having been reported. In addition to these two species the leaflets of several others are sometimes met with in commerce. *Ceara jaborandi.*—This variety is obtained from PILOCARPUS TRACHYLOPHUS. The leaflets are distinguished by having a hairy under-surface, and by not causing a flow of saliva when chewed; the fruit also is readily distinguishable from that of P. Jaborandi. This variety yields about 0·47 per cent of alkaloid differing from pilocarpine. *Rio Janeiro jaborandi*, the product of P. SELLOANUS, is similar to the Pernambuco variety, but has more fleshy leaflets, which are further distinguished by being elliptic-oblong in shape and by having the veinlets more prominent on the upper surface. Maranham Jaborandi is derived from *P. microphyllus* and is official as an alternative to P. Jaborandi in the U.S.P., the leaflets are much smaller than in other varieties, being one-half to one and a half inches long and one-third to two-thirds inch broad; obovate, emarginate. Jaborandi is required by the U.S.P. to yield not less than 0·5 per cent. of total alkaloids. *P. racemosus* (Guadeloupe Jaborandi) is a West Indian species giving 0·26 per cent. alkaloid. *P. spicatus* (Aracati Jaborandi) has simple, lanceolate hairy leaves and has been reported to contain 0·16 per cent. of alkaloid.

Other jaborandis are the leaves of several species of Piper, the term being applied in Brazil in a generic sense to various pungent, sudorific plants.

Chemistry.—Volatile oil, 0·2 to 1 per cent. (containing dipentene and other hydrocarbons), and the alkaloids *pilocarpine* ($C_{11}H_{16}N_2O_2$) and *isopilocarpine* ($C_{11}H_{16}N_2O_2$). By the action of acids and alkalies pilocarpine is converted into *isopilocarpine*. *Pilocarpidine* ($C_{10}H_{14}N_2O_2$) was probably

present in the leaves of true P. Jaborandi but is not found in the present commercial varieties. *Jaborine* formerly described as an independent alkaloid was probably a mixture.

Uses, etc.—Diaphoretic, sialagogue, etc.; antagonistic to belladonna. *Dose.*—5 to 20 grains.

B.P. Preparations.

Extractum Jaborandi Liquidum	1 part in 1 of alcohol (45 per cent.)
Pilocarpinæ Nitras.	
Tinctura Jaborandi	1 part in 5 of alcohol (45 per cent.)

B.P.C. Preparations.—Extractum Jaborandi, Infusum Jaborandi.

PILOCARPINÆ NITRAS B.P. ($C_{11}H_{16}N_2O_2HNO_3$), is the nitrate of an alkaloid obtained from extract of Jaborandi by shaking it with chloroform and alkali, evaporating the chloroformic solution, neutralizing the product with nitric acid, and purifying by re-crystallization from strong alcohol. It occurs as a white crystalline powder or in acicular crystals, soluble 1 in 8 of water, 1 in 50 of rectified spirit. With strong sulphuric acid it gives a yellowish solution, which on the addition of bichromate of potassium acquires an emerald-green colour. The Pharmacopœia does not give a melting point and much of the pilocarpine nitrate of commerce is very impure. The pure salt should melt at 178° C. (*Fowett*), while samples melting as low as 139° C. have been met with. *Dose.*—$\frac{1}{20}$ to $\frac{1}{2}$ grain. From it are prepared various "guttæ" and hypodermic injections. The hydrochloride of pilocarpine is official in the Pharmacopœia of the United States, and in several of those of the European Continent.

ILEX PARAGUAYENSIS.—Paraguay Tea.—The leaves of Ilex Paraguayensis, *Hooker.*

N.O.—Ilicaceæ.

Syn.—Maté.

Habitat.—Brazil.

Characters.—Short-petiolate, lanceolate-oblong, about two inches in length, nearly obtuse, margin dentate; odour slight; taste bitter and astringent. Usually met with in commerce in the form of a highly-dried coarse powder.

Chemistry.—Tannin (10 to 16 per cent.), *caffeine* ($\frac{1}{4}$ to $1\frac{1}{2}$ per cent), volatile oil, fat, etc.

Uses, etc.—Similar to those of the other caffeinic drugs.

RHUS TOXICODENDRON.—Poison Oak.—The fresh leaves of Rhus toxicodendron, *Linn.* and Rhus radicans, *Linn.*

N.O.—Anacardiaceæ.

Syn.—Poison ivy.

Habitat.—North America.

Characters.—Long-petiolate, trifoliate; the lateral leaflets sessile, about four inches long, obliquely-ovate, pointed; the terminal leaflets stalked, ovate or oval, pointed, with wedge-shaped base; the leaflets entire and glabrous (in Rhus radicans) or variously notched, coarsely toothed or lobed, downy beneath (in Rhus toxicodendron). When dry, papery and brittle; inodorous; astringent and acid.

Chemistry.—A fixed oil (*toxicodendrol*), (3 to 4 per cent.) tannin, etc. The plant owes its activity to the oil, which is an intense cutaneous poison.

Uses, etc.—Irritant, rubefacient. *Dose.*—2 to 5 grains. Formerly official in the U.S.P. Usually given in tincture (Tinctura Rhois).

Note.—The fresh leaves abound with an acrid juice, which darkens when exposed to air, and when applied to the skin produces inflammation and swelling. They, therefore, require to be handled cautiously when fresh.

SENNA ALEXANDRINA.—Alexandrian Senna.—The dried leaflets of Cassia acutifolia, *Delile* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 90]

N.O.—Leguminosæ.

Habitat.—North-east Africa.

B.P. Characters.—Pale greyish-green, thin, brittle leaflets, usually varying from three-quarters to one inch and a quarter (twenty to thirty-two millimetres) in length. They are mostly lanceolate, sometimes oval-lanceolate, in outline; acute, entire, and unequal at the base, the greatest diameter being frequently below the middle of the leaflet. The surface is usually very finely pubescent, and the veins on the under surface are distinct. The epidermis bears one-celled, thick-walled hairs. The odour is faint but characteristic; the taste mucilaginous and somewhat unpleasant.

The main difference between the two sennas is that the leaflets of the Alexandrian are shorter and brittle, while those of the Indian are lanceolate, acute, two inches long, flexible. The inequality of the base and freedom from bitterness render senna leaflets easily identifiable.

Varieties of Senna.—Besides the Alexandrian and Indian Sennas, others are met with in commerce, either alone or as an admixture of the official kinds. Of these the more important are: *East Indian*, or *Bombay Senna*, probably derived from a wild variety of Cassia angustifolia (the C. elongata of Lemaire), which is collected in Arabia and sent to Europe and the United States viâ Bombay, and is known by the French as *Sené de la pique*, on account of the great length and narrowness of the leaflets; *Tripoli Senna*, an inferior Alexandrian variety, having the leaflets in fragments; *American Senna* (Cassia marilandica); *Italian* and *Jamaica* kinds (Cassia obovata), so called because cultivated in these countries, and known by the Arabs as *Senna baladi*, but now little collected. Great care has to be paid to the sorting of senna leaves, for not only do leaves of other plants find their way into the bales, but also such extraneous matters as dust, dirt, date stones, twigs, petioles, fruits, flowers, etc.

Chemistry.—The purgative constituents of Senna are closely allied to those of Aloes and Rhubarb, the activity of the drug being largely due to glucosides of the oxymethylanthraquinone group, *anthraglucosennin* and *glucosennin* having been described. *Emodin*, *isoemodin*, *chrysophanic acid*, *sennigrin*, *rhamnetin*, extracted from the leaves are probably hydrolytic products of these glucosides. There are also present organic acids, gum, a sugar

catharto-mannite, volatile oil, etc. *Cathartic Acid* which possesses purgative properties is now supposed to be a mixture of glucosides. The ash amounts to about 8 per cent., consisting chiefly of earthy and alkaline carbonates. The best solvent of senna is dilute alcohol; prolonged decoction of the leaves entirely destroys their purgative power.

Uses, etc.—As a general purgative. *Dose.*—10 to 30 grains in powder.

B.P. Preparations.

Confectio Sennæ - - -	1 part in 11, about.
Infusum Sennæ - - -	1 in 10.
Liquor Sennæ Concentratus -	1 in 1.
Mistura Sennæ Composita -	containing the infusion.
Pulvis Glycyrrhizæ Compositus,	1 part in 6.
Syrupus Sennæ - - -	1 in 2, nearly.
Tinctura Sennæ Compositus -	1 in 5 of alcohol (45 per cent.)

B.P.C. Preparations.—Infusum Sennæ Concentratum, Infusum Sennæ Comp., Elixir Sennæ, Confectio Sennæ et Sulphuris, Syrupus Mannæ Comp.

Note 1.—Substitutions and Adulterations.

Bladder Senna Leaflets (Colutea arborescens. *N.O.*—Leguminosæ). These have equal bases, are elliptical in outline, and bluntly pointed; a Continental substitution.

Coriaria Myrtifolia Leaves.—A Mediterranean shrub. (*N.O.*—Coriaraceæ). As these leaves are poisonous, this is a very serious admixture. They are ovate-lanceolate, equal at the base, three-veined, with a strongly marked midrib. The two lateral veins run in a longitudinal direction along the leaf until they reach the apex, where they disappear.

Tephrosia Leaflets and Legumes. (Tephrosia apollinea. *N.O.*—Leguminosæ, from the banks of the Nile). These have a silky or silvery aspect, obovate-oblong, emarginate at apex, equal at base, usually folded longitudinally on their midrib. The legume is an inch to an inch and half long, not exceeding one-sixth of an inch broad, linear, slightly ensiform, and contains six to seven brownish seeds.

Argel Leaves.—(Solenostemma [vel Cynanchum] argel. *N.O.*—Asclepiadaceæ, from Nubia). These are paler in colour, more coriaceous, and have less conspicuous veins and an equal base. The fruits are small and pear-shaped, and not like legumes.

Jaborandi Leaflets.—The leaflets of Pilocarpus microphyllus have been imported under the name of Senna.

Note 2.—Senna fruits or pods have much the same composition as the leaves and have been used as a substitute. The B.P.C. contains a fluid extract.

SENNA INDICA.—East Indian Senna.—

The dried leaflets of Cassia angustifolia, *Vahl.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 91]. From plants cultivated in Southern India.

N.O.—Leguminosæ.

Syn.—Tinnivelly Senna.

Habitat.—Southern India.

B.P. Characters.—Usually varying from one to two inches (two and a half to five centimetres) in length, lanceolate, acute, the greatest diameter being usually near the middle of the leaflet; unequal at the base, thin, entire, yellowish-green and smooth above, somewhat duller beneath, and glabrous or

slightly pubescent. In odour and taste very similar to Alexandrian Senna.

Chemistry.—These leaflets contain more gummy matter than is found in Alexandrian Senna, and are said to yield a smaller percentage of glucosidal constituents.

B.P. Preparations.

May be used in place of Alexandrian Senna.

LAUROCERASI FOLIA.—Cherry-Laurel Leaves.—The fresh leaves of Prunus Laurocerasus, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 98].

N.O.—Rosaceæ.

Habitat.—Britain, etc.

B.P. Characters.—Thick, coriaceous, on short strong petioles, oblong or somewhat obovate, from five to seven inches (twelve and a half to seventeen centimetres) in length, tapering towards each end, recurved at the apex, distinctly but sharply serrate and slightly revolute at the margins, dark green, smooth, and shining above, much paler beneath, and with a prominent midrib, on either side of which, near the base, are one or two glandular depressions. Inodorous, but emitting when bruised an odour resembling that of bitter almond.

Chemistry.—A glucoside *laurocerasin* is present with the ferment *emulsin*, and the bruised leaves, when distilled, yield volatile oil (benzaldehyde) and hydrocyanic acid. Laurocerasin is similar to, but not identical with, amygdalin (*see* Amygdala). It is said that the leaves contain some of the volatile oil ready formed.

Uses, etc.—As a source of cherry-laurel water.

B.P. Preparation.

Aqua Laurocerasi, containing one-tenth per cent. of HCN.

HAMAMELIDIS FOLIA.—Hamamelis Leaves.—The leaves, fresh and dried, of Hamamelis virginiana, *Linn.*

N.O.—Hamamelaceæ.

Syn.—Witch Hazel leaves.

Habitat.—Canada and United States.

B.P. Characters.—Broadly oval in outline, usually varying in length from three to six inches (seven to fifteen centimetres). The upper surface is dark green or brownish-green in colour, the under surface paler; the apex is obtuse, the margin sinuate. The leaves are narrowed towards the base, oblique, slightly cordate and shortly petiolate. They are pinnately veined, the veins being prominent on the under surface, where

they are furnished with stellate hairs. They have an astringent, slightly bitter taste, but no marked odour.

Chemistry.—Tannin, and a trace of volatile oil.

Uses, etc.—Astringent.

B.P. Preparations.

*Extractum Hamamelidis Liquidum - 1 part in 1 of alcohol (45 per cent.)

Liquor Hamamelidis - distilled from fresh leaves.

**Used in preparing*

Unguentum Hamamelidis - - - 1 part in 10.

ANHALONIUM.—**Pellote.**—The leafy tops of Anhalonium (Lophophora) lewinii, *Lemaire*, A. Williamsii, *Linn.*, etc.

N.O.—Cactaceæ.

Syn.—Mescal button.

Habitat.—Mexico.

Characters.—Composed of blunt leaves bent round a tuft of short yellowish hairs. The so-called "mescal button" is from an inch to an inch and a half in diameter, a quarter of an inch in thickness; under surface convex; brittle when dry, soft when moistened; taste bitter, unpleasant; odour peculiar, disagreeable.

Chemistry.—*Anhalonine* ($C_{12}H_{15}NO_3$) *mescaline, anhalonidine, lophophorine, pellotine, anhaline.*

Uses, etc.—Used as a narcotic by the Indians of Rio Grande. Has been recommended as a nerve stimulant, as also in treatment of gout. *Dose.*—7 to 15 grains in powder.

EUCALYPTI FOLIA.—**Eucalyptus Leaves.**—The dried leaves of Eucalyptus globulus, *Labill.*

N.O.—Myrtaceæ.

Syn.—Blue-Gum Tree.

Habitat.—Australia, Tasmania, etc.

Characters.—The leaves obtained from young plants, which are deficient in active constituents, are opposite, shortly petiolate, broadly oval or oblong, rather obtuse, heart-shaped at the base, and a pale, bluish-green colour. The leaves from older trees are alternate, petiolate, lanceolately scythe-shaped, or oval-lanceolate scythe-shaped, or oval-lanceolate, oblique at the base, entire, and above gradually tapering to the acute apex. They are six to twelve inches in length, are thick, coriaceous, and of a pale, yellowish-green colour, containing numerous pellucid oil-glands, and have, besides the prominent midrib, two lateral veins near the margin. Odour peculiar, strong, and balsamic; taste aromatic, bitterish, and pungent, and followed by a sensation of coolness.

Chemistry.—Volatile oil, tannin, fat and resin.

Uses, etc.—The fresh leaves are one of the officially-named sources of Oleum Eucalypti B.P. (*q.v.*). The dried leaves are official in the U.S.P. for the production of a fluid extract, and the B.P.C. has a tincture, 1 in 5.

Note.—The Eucalyptus genus is a characteristic feature of Australian landscapes, There are about 150 described species, all evergreens, and most of them large trees, When grown in miasmatic districts they are reputed to purify the atmosphere. The leaves yield 2·75 per cent. of oil when fresh, and 6 per cent. when recently dried, but by keeping the leaves, the percentage of oil decreases.

MYRCIÆ FOLIA.—Bay Leaves.—The leaves of Pimenta (Myrcia) acris, *Wight*.

N.O.—Myrtaceæ.

Habitat.—West Indies.

Syn.—Wild clove leaves.

Characters.—Opposite, three to five inches long; very coriaceous, lanceolate, obtuse, wavy, somewhat revolute at the edges, with numerous parallel nerves, reticulated on the upper surface, and sprinkled with pellucid dots; fragrant odour, and somewhat astringent taste.

Chemistry.—Volatile oil, containing eugenol.

Uses, etc.—For the production of the volatile oil which is an ingredient of the so-called *bay rum*.

CHEKAN.—Chequen.—The leaves of Eugenia Chequen, *Mol.*

N.O.—Myrtaceæ.

Habitat.—Chili.

Characters.—Nearly sessile, oval-lanceolate or elliptic, about one inch long, with somewhat revolute margin; light-green, smooth, delicately wrinkled, pellucid-punctate, aromatic.

Chemistry.—Contains volatile oil, tannin, and four principles, viz., *chekenon*, *chekenin*, *chekenetin*, and *cheken-bitter*.

Uses, etc.—In chronic bronchitis, etc. *Dose.*—30 to 60 grains in fluid extract.

DAMIANA.—Damiana.—The leaves of Turnera diffusa aphrodisiaca, *Urban*.

N.O.—Turneraceæ.

Habitat.—Mexico.

Characters.—Short petiolate, obovate or obovate-lanceolate, about one inch long, somewhat obtuse, with a wedge-shaped base and widely dentate margin, light green, smooth. Odour and taste aromatic.

Chemistry.—Volatile oil, resins, and a bitter substance.

Uses, etc.—As tonic, diuretic, and aphrodisiac. *Dose.*—30 grains.

The *B.P.C.* includes Extractum Damianæ, Extractum Damianæ Liquidum, and Mistura Damianæ Comp.

Note.—False Damiana is said to be the leaves of APLOPAPPUS DISCOIDEUS (*N.O.*—Compositæ). These are distinctly lanceolate, and have only two or three teeth on each side.

CONII FOLIA.—Conium Leaves.—The fresh leaves and young branches of Conium maculatum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 118], collected when the fruit begins to form.

N.O.—Umbelliferæ.

Syn.—Cicutæ folia; Cigue feuille.

Habitat.—Britain.

B.P. Characters and Test.—The leaves are more or less divided in a pinnate manner, the lower decompound and sometimes two feet (nearly seventy centimetres) in length, glabrous, and arising from a smooth stem marked with dark purple spots;

the clasping petioles are of varying length, those of the lower leaves being hollow. The ultimate divisions of the leaves terminate in smooth, colourless, horny points. The odour is strong and disagreeable, resembling that of mice, more especially when rubbed with *solution of potassium hydroxide*.

Chemistry.—The leaves contain small quantities of the alkaloids, *coniine* or *conine* ($C_8H_{17}N$) *see Conii fructus*, *methyl-coniine* ($C_9H_{19}N$), *conhydrine* ($C_8H_{17}NO$), *pseudo-conhydrine* and *ethyl-piperidine* ($C_7H_{15}N$); *coniceine* has also been described. A trace of volatile oil is also present with albumin, mucilage, etc., and about 12 per cent. of ash.

Coniine has been prepared synthetically by reduction from *allyl-pyridine* $C_5H_4(C_3H_5)N$, the first stage in the process being the formation of α-*normal propyl piperidine*, which is optically inactive, but which, in the form of tartrate, splits up into dextro and lævo-rotatory coniine. Coniine is therefore regarded as a pyridine derivative. (*See* Addendum, Alkaloids).

Note.—The leaves lose much of the alkaloid by drying, and the extract (formerly official) has been shown to be very variable, and consequently unreliable, on account of a similar loss during its manufacture.

Uses, etc.—Externally and internally as an anodyne. *Dose*.—2 to 8 grains in powder. Said to have been the State poison of the Greeks.

B.P. Preparation.

Succus Conii, *which is used in preparing*
Unguentum Conii - - - - - 2 parts in 1.

B.P.C. Preparations.—Extractum Conii (formerly official), Cataplasma Conii, Vapor Coniinæ.

Note.—Adulterations and Substitutions.—The following Umbelliferous plants have been noticed:—

1. Œnanthe crocata (*The Water-Dropwort*).)—The root is tuberculated; the juice becomes yellow when exposed to the air; the fruit is much longer than that of Conium, more cylindrical, and has two long, persistent styles.

2. Æthusa cynapium (*Fools' Parsley*).—An annual garden weed. It has no general involucre, and the partial involucre consists of two to three linear pendulous bracts. The ridges of the cremocarp are not wavy, and the stem has no purple spots.

3.—Chærophyllum temulum (*Rough Chervil*). This plant has a rough spotted stem and swollen joints. The lower leaves are pubescent or ciliated, and the fruits are one-quarter of an inch long, and linear-oblong, and have five obtuse ribs, with vittæ between them.

4.—Cicuta virosa (*Cowbane*).—Has a præmorse root; the leaflets are lanceolate or sharply serrate, and the cremocarps are globular.

HYDROCOTYLE.—Indian Pennywort.—The leaves of Hydrocotyle asiatica, *Linn*.

N.O.—Umbelliferæ.

Habitat.—Tropical Asia and Africa.

Characters.—The leaflets are petiolate, reniform, crenate, seven-nerved, and glabrous, or nearly so.

Chemistry.—An oily volatile liquid, *vellarin* (1 per cent.) and tannic acid.

Uses, etc.—Employed by the natives as an alterative tonic; included in the Indian Pharmacopœia, where it is prescribed in powder or as a poultice for application to syphilitic ulcers.

Note.—The European variety (Hydrocotyle vulgaris) is not unlike this, but has orbicular and peltate leaves.

COMBRETUM SUNDAICUM.—

N.O.—Combretaceæ.

Habitat.—Malay Peninsula, Sumatra.

The leaves of this plant have recently been used in the form of a decoction of the roasted leaves as a cure for the opium habit amongst the Chinese.

The drug has been chemically examined with results for the most part negative. Traces of a glucoside are present.

UVÆ URSI FOLIA.—Bearberry Leaves.

—The dried leaves of Arctostaphylos Uva-ursi, *Spreng.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 163].

N.O.—Ericaceæ.

Syn.—Arbutos Uva-ursi.

Habitat.—Britain.

B.P. Characters.—Yellowish green, obovate or spathulate, coriaceous leaves, usually about three-quarters of an inch (eighteen millimetres) in length. They are entire and very shortly petiolate. The upper surface is glabrous, shining and reticulate, and the veinlets are depressed. The leaves have no definite odour, but a very astringent taste.

Chemistry.—Tannin (6 to 7 per cent.), gallic acid, *arbutin* ($C_{24}H_{32}O_{14}$, a crystalline glucoside), *ericolin*, *ursone*, and a yellow colouring principle resembling quercetin. Arbutin is bitter, soluble in alcohol and hot water, decomposed by acids into glucose and hydroquinone. Ericolin, a frequent constituent of Ericaceous plants, is similarly decomposable into glucose and *ericinol*.

Uses, etc.—Astringent, tonic, and diuretic. *Dose.*—10 to 30 grains in powder.

B.P. Preparation.

Infusum Uvæ Ursi - - - - - - 1 in 20.

Preparations other than B.P.—Concentrated infusion B.P.C. and fluid extract U.S.P.

Note.—Allied Species.—*Manzanita*, the leaves of Arctostaphylos glauca, from California, are employed like uva ursi. They are petiolate, ovate-oblong, about two inches long, usually acute above and obtuse at base, glaucously pale green; inodorous, astringent, and somewhat bitter. They contain arbutin, etc. The leaves of A. polifolia (from Mexico), A. tomentosa (*madrona*), are also used in medicine.

Adulterations and Substitutions.—The leaves of the *box tree* (Buxus sempervirens. *N.O.*—Euphorbiaceæ) are oval and emarginate at the apex, and have the epidermis loose and separable on the under surface of the leaf. They are devoid of astringency, and an aqueous infusion gives little or no precipitate with ferric chloride solution.

The leaves of the *red whortleberry tree* (Vaccinium vitis-idæa. *N.O.*—Vacciniaceæ) are minutely crenate and revolute, and the margins are dotted on the under surface. They are but very slightly astringent.

CHIMAPHILA.—**Pipsissewa.**—The leaves of Chimaphila umbellata, *Nutt.* (Pyrola umbellata).

N.O.—Ericaceæ.

Syn.—Pipsissewa, Bitter Wintergreen.

Habitat.—Europe, Asia, and North America.

Characters.—About two inches long, ob-lanceolate, sharply serrate above, wedge-shaped, and nearly entire at the base; coriaceous, smooth, and dark-green on the upper surface. It is nearly inodorous, and has an astringent and bitterish taste.

Chemistry.—Bitter extractive, *chimaphilin*, arbutin, volatile oil, a resin, and tannic acid (4 per cent.)

Uses, etc.—Astringent, diuretic, etc. *Dose.*—15 to 60 grains. Official in the U.S.P. for the production of a fluid extract.

Note.—CHIMAPHILA is also sometimes known under the name of wintergreen; hence the erroneous application of the name of Oleum Pyrolæ to Oil of Wintergreen.

GAULTHERIA.—**Wintergreen.**—The leaves of Gaultheria procumbens, *Linn.*

N.O.—Ericaceæ.

Habitat.—Canada and United States of America.

Characters.—Shortly petiolate, obovate or roundish-oval, about one and a half inches long, three-quarters of an inch or more broad, mucronate, slightly serrate, with adpressed teeth; coriaceous, smooth, glossy-green above, pale beneath; odour fragrant; taste aromatic and astringent.

Chemistry.—Volatile oil (0·5 per cent.), which consists almost entirely of *methyl salicylate*, $C_6H_4(OH)COOCH_3$, S.G. 1·175. It is probable that the oil exists as such in part in the leaves, the major portion being produced by the action of the ferment *betulase* upon the glucoside *gaultherin*. Tannic acid, gallic acid, arbutin, ursone, and ericolin, are also present.

Uses, etc.—Stimulant, diuretic, etc. *Dose.*—15 to 60 grains. Formerly official in the United States; the volatile oil only is now included in the U.S.P.

Note.—*Oil of Wintergreen* is practically identical with *Oil of Birch* (from the bark of BETULA LENTA. *N.O.*—Betulaceæ) which is said to be sold indiscriminately, either alone or mixed with the oil from Gaultheria, under the name of Oil of Wintergreen. Large quantities of methyl salicylate are produced synthetically and used for the same purpose as the natural oil, of which it is the chief constituent.

LEDUM.—**Ledum.**—The leaves of Ledum palustre, *Linn.*

N.O.—Ericaceæ.

Syn.—Marsh tea.

Habitat.—North Europe, etc.

Characters.—The leaves of this evergreen shrub contain tannin, volatile oil, ericolin, ericinol, resin, etc., and have been employed in dysentery and in cutaneous diseases.

Note.—*Labrador Tea* is the leaves of LEDUM LATIFOLIUM, from Canada. Its properties are similar to those of the above.

OLEÆ FOLIA.—**Olive Leaves.**—The leaves of Olea Europœa, *Linn.*

N.O.—Oleaceæ.

Habitat.—Shores of the Mediterranean.

Characters.—Somewhat coriaceous in texture, dark-green above, pale below, lanceolate, mucronate with entire revolute margins, shortly petiolate, taste slightly bitter and astringent.

Chemistry.—A crystalline principle, *oleanol* (3·4 per cent.) $C_{31}H_{48}O(OH)_2,H_2O$; crystalline alcohols, *oleasterol*, *olestranol* and *homo-olestranol*, a glucose, d-mannitol and resins have been recently isolated.

Uses, etc.—Tonic, antiperiodic, febrifuge.

The *B.P.C.* contains Extractum Oleæ foliorum, and Tinctura Oleæ foliorum.

Note.—The constituents of Olive bark differ considerably from those of the leaves, *olenitol* (crystalline, phenolic), *ipuranol* (monohydric alcohol), etc., have been shown to be present.

OLEANDER.—Oleander.—The leaves of Nerium Oleander, *Linn.*

N.O.—Apocynaceæ.

Syn.—Laurien Rose.

Habitat.—Basin of the Mediterranean.

Characters.—Nearly sessile, linear-lanceolate, four inches long, finely pointed, somewhat revolute, smooth, glossy above, feather-veined; inodorous, bitter, nauseous.

Chemistry.—*Neriin* (allied to digitalin), and a glucoside, *oleandrin*.

Uses, etc.—As cardiac tonic, etc., actively poisonous.

TYLOPHORÆ FOLIA.—Tylophora Leaves.—The dried leaves of Tylophora asthmatica, *Wight et Arnott.*

N.O.—Asclepiadaceæ.

Syn.—Indian Ipecacuanha.

Habitat.—India.

Characters.—From two to three inches long, entire, ovate-acuminate, cordate at the base, glabrous above, downy beneath. They have a heavy disagreeable smell when bruised, and a nauseous taste.

Chemistry.—The alkaloid, *tylophorine*, which has been found in the root of this plant, is also probably present in the leaves.

Uses, etc.—Official in the Indian and Colonial Addendum as a substitute for Ipecacuanha.

MENYANTHES.—Buckbean.—The leaves of Menyanthes trifoliata, *Linn.*

N.O.—Gentianaceæ.

Syn.—Bogbean.

Habitat.—Europe, etc.

Characters.—The leaves are on petioles, four to six inches long, alternate; the leaflets are sessile, about two inches long, obtuse-oblong or obovate, the margin is slightly crenate, smooth, and pale green. They are inodorous, and have a very bitter taste, free from astringency.

Chemistry.—A small quantity of volatile oil and *menyanthin* $C_{33}H_{50}O_{14}$ (a bitter glucoside). The bitterness is imparted to both alcohol and water.

Uses, etc.—Tonic and cathartic. *Dose.*—15 to 45 grains in preparations. Two ounces of dried leaves are said to be equivalent to one pound of hops for brewing purposes.

ERIODICTYON.—Eriodictyon. The leaves of Eriodictyon californicum, *Greene*.

N.O.—Hydrophyllaceæ.

Syn.—Mountain balm, Jerba (Yerba) santa.

Habitat.—California.

Characters.—Oblong-lanceolate, two to four inches long, acute at the apex, and below narrowed into a short petiole, the margin sinuately toothed to nearly entire; upper surface green, smooth, and covered with a brownish resin; lower surface reticulate and minutely white, tomentose; odour aromatic, taste balsamic, sweetish.

Chemistry.—Essential oil, resins (29 per cent.), the phenolic bodies *eriodictyol* ($C_{15}H_{12}O_6$), and *homo-eriodictyol* ($C_{16}H_{14}O_6$).

Uses, etc.—As stimulant expectorant. *Dose.*—30 to 60 grains. Official in the U.S.P. for the production of a fluid extract.

STRAMONII FOLIA.—Stramonium Leaves.—The dried leaves of Datura Stramonium, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 192].

N.O.—Solanaceæ.

Syn.—Thornapple.

Habitat.—Britain.

B.P. Characters.—Ovate petiolate leaves, usually varying from four to six inches (ten to fifteen centimetres) in length. They are unequal at the base, the margin is sinuate-dentate and the apex acuminate. The upper surface is dark greyish-green and minutely wrinkled; the under surface is paler. The mesophyll contains cluster-crystals of calcium oxalate. The leaves have a characteristic odour, and an unpleasant bitter taste.

Chemistry.—*Atropine* and *hyoscyamine*, 0·3 to 0·4 per cent. The U.S.P. requires at least 0·35 per cent. of mydriatic alkaloids. Mucilage, albumin, and ash (17 per cent. rich in potassium nitrate) are also present. *Daturine* was the name given to a mixture of alkaloids obtained from the leaves.

Uses, etc.—For purposes similar to those for which Belladonna is used. Much employed in asthma powders, and as an ingredient of medicinal cigarettes.

B.P. Preparation.

Tinctura Stramonii - 1 in 5 of alcohol (45 per cent.)

Preparations other than B.P.—The U.S.P. has standardised extract (1·4 per cent. alkaloid) and fluid extract (0·35 per cent. alkaloid).

The *B.P.C.* includes Extractum Stramonii Exsiccatum (1·0 per cent. alkaloid), Pulvis Stramonii Comp., Pulvis Lobeliæ Comp.

Note.—DATURA TATULA is very similar, but has leaves of a deep green, and stems and flowers of a purple colour.

HYOSCYAMI FOLIA.—Hyoscyamus Leaves.—The fresh leaves and flowers, with the branches to which they are attached, of Hyoscyamus niger, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 194]; also the leaves and the flowering tops, separated from the branches and carefully dried. Collected from the flowering biennial plants.

N.O.—Solanaceæ.

Syn.—Henbane Leaves.

Habitat.—Britain.

B.P. Characters.—The leaves vary in length, but seldom exceed ten inches (twenty-five centimetres), and are mostly sessile; they are alternate, exstipulate, triangular-ovate or ovate-oblong, acute, undulated, irregularly toothed, sinuate or pinnatifid; they have a conspicuous midrib, and are pale green, and furnished with glandular hairs, particularly along the veins and on their under surface. The branches are sub-cylindrical, and also furnished with glandular hairs. The corolla is yellowish with a network of purplish veins. The mesophyll of the leaf contains small prisms of calcium oxalate. The fresh herb has a strong characteristic odour, a bitter and slightly acrid taste.

In the dry state the official leaves are in nodules, having flowers amongst them, which are easily recognised by the light-coloured corollas, marked with purple reticulated veins. The leaves of the first year of the biennial plant are radical with conspicuous petioles. Annual henbane has shorter leaves, and primrose-coloured flowers, with few purple streaks, and the whole plant is less hairy, of a lighter colour and less marked odour.

Chemistry.—The alkaloids *hyoscyamine* ($C_{17}H_{23}NO_3$) and *hyoscine* ($C_{17}H_{21}NO_4,H_2O$) are present together with a glucoside *hyoscypicrin*, mucilage, protein, etc. Hyoscyamine is isomeric, but not identical, with atropine. Hyoscine is identical with scopolamine, the alkaloid obtained from Scopola. The total alkaloidal content has been variously stated but seems to average 0·1 per cent., the U.S.P. fixing a minimum standard of 0·08 per cent.

Note. Formerly the second year's growth of the biennial plant was thought to contain a considerably larger percentage of alkaloid than either the first year's growth of the same plant or the annual plant, but it is now held that leaves from English-grown species of all of the above are practically of equal alkaloidal value; the German imported drug is however of much less value.

Uses, etc.—Similar to Belladonna and Stramonium, but milder in proportion.

B.P. Preparations.

*Extractum Hyoscyami, from expressed juice; yield, $4\frac{1}{2}$ to $5\frac{1}{2}$ per cent.

Hyoscyaminæ Sulphas.

Hyoscinæ Hydrobromidum.

Succus Hyoscyami.

Tinctura Hyoscyami, 1 part in 10 of alcohol (45 per cent.)

**Contained in*

Pilula Colocynthidis et Hyoscyami - - 1 part in 3.

Hyoscyaminæ Sulphas P.B. $(C_{17}H_{23}NO_3)_2\,H_2SO_4,\,2H_2O$, is a crystalline deliquescent powder, melting at 206°C. It is readily soluble in water and in alcohol, slightly in ether and chloroform. It gives no precipitate with platinic chloride, but with auric chloride a yellow precipitate soluble in boiling dilute hydrochloric acid, and redeposited in yellow scales on cooling. (Under similar treatment atropine sulphate gives minute crystals, pulverulent when dried. *See atropine*). *Dose.*—$\frac{1}{200}$ to $\frac{1}{100}$ grain.

Hyoscinæ Hydrobromidum P.B. (Scopolamine Hydrobromide) $C_{17}H_{21}NO_4$, HBr, $3H_2O$, is obtained in colourless, transparent, rhombic crystals. It is soluble in water (readily), in alcohol (fairly readily) in ether and chloroform (slightly). It is precipitated by mercuric chloride and by potash, but not by ammonia. *Dose.*—$\frac{1}{200}$ to $\frac{1}{100}$ grain.

HYOSCYAMUS MUTICUS.—Indian or Egyptian Henbane.

—The dried leaves and stems of Hyoscyamus muticus, *Linn.*

N.O.—Solanaceæ.

Habitat.—Egypt, Asia.

Syn.—Sakran.

Characters.—The drug occurs in three forms, as a mixture of stem, leaf and fruit in which stem predominates, as leaves with little stem, and as seeds; the first named is the variety usually met with. The stems are dry, hollow and brittle, yellow in colour, and from one-quarter to three-quarters of an inch in diameter.

Chemistry.—*Hyoscyamine* practically pure occurs in the drug in considerably greater proportion than in the European herb, the Egyptian grown plant being much richer than the Indian. The former has yielded as much as 0·91 per cent. of total alkaloid.

Uses, etc.—Anodyne, antispasmodic, etc.

BELLADONNÆ FOLIA.—Belladonna Leaves.

—The fresh leaves and branches of Atropa Belladonna, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 193], collected when the plant is in flower.

N.O.—Solanaceæ.

Habitat.—Britain, Europe (central, etc).

B.P. Characters.—The leaves have short stalks, are alternate below but in unequal pairs above. They are from three to eight inches (eight to twenty centimetres) long, broadly ovate, acute, entire, and glabrous or nearly so. The corolla is gamopetalous, campanulate, and of a dingy purple colour.

The transverse section of the leaf exhibits bi-collateral vascular bundles; the mesophyll contains numerous cells filled with very minute crystals of calcium oxalate.

Chemistry.—*Atropine* and *hyoscyamine* 0·3 to 0·6 per cent. (*see* Belladonna root). The U.S.P. requires at least 0·35 per cent. The amount of alkaloids present varies somewhat according to whether the leaves are from wild or from cultivated plants, and largely according to the methods of drying and storing adopted. Malic acid, mucilage, wax, protein, etc., are also present. It has been questioned whether atropine is pre-existent in the drug or whether it is formed from its isomer hyoscyamine.

Uses, etc.—Anodyne, diuretic, narcotic; in large doses dilates the pupil. Dose.—$\frac{1}{2}$ to 3 grains.

B.P. Preparations.

*Atropina.

Extractum Belladonnæ Viride, from expressed juice, yield about 4 per cent.

Succus Belladonnæ.

**Used in the preparation of*

Unguentum Atropinæ - - - 1 part in 50.

Atropinæ Sulphas.

The latter contained in

Lamellæ Atropinæ - - - - $\frac{1}{5000}$ grain in each.

Liquor Atropinæ Sulphatis - - - 1 part in 100.

B.P.C. Preparations.—Extractum Belladonnæ Exsiccatum (1 per cent. alkaloids), Collyrium Belladonnæ, Emplastrum Belladonnæ Viride, Glycerinum Belladonnæ, etc.

Note.—Adulterations and Substitutions.—Care should be exercised in the examination of these leaves, for sometimes digitalis, hyoscyamus, verbascum, and stramonium leaves are found amongst them. The entire margin of belladonna leaves is perhaps the most useful distinguishing characteristic in the dried state.

TABACI FOLIA.—Tobacco Leaves.—The dried leaves of Nicotiana Tabacum, *Linn.*

N.O.—Solanaceæ.

Habitat.—America; cultivated.

Characters.—Large, being sometimes more than twenty inches long; ovate-lanceolate or oval-oblong, acute, entire, brown, brittle, glandular hairy; having a characteristic odour and nauseous bitter, acrid taste; yielding, when distilled with solution of potash, an alkaline fluid which has the peculiar odour of nicotine, and precipitates with perchloride of platinum and tincture of galls.

Chemistry.—A colourless, liquid, volatile alkaloid, *nicotine* ($C_{10}H_{14}N_2$), with an acrid odour, and an acrid burning taste, is the most important constituent, and is present to the extent of from 1 to 9 per cent. There are also present: a white crystalline, volatile body, *nicotianin* (the chemical nature of which is not yet properly understood); protein, resin, gum, extractive, citric and malic acids, and a large amount of ash (14 to 20 per cent.). Nicotine has S.G. 1·011, is inflammable, soluble in water, ether, alcohol, and the fixed oils; it is powerfully poisonous.

Uses, etc.—Tobacco is but little used in medicine; an infusion is made use of as an insecticide, as also are impure nicotine and the powdered midribs of the leaves.

DUBOISIA.—Duboisia.—The leaves of Duboisia myoporoides, *R. Brown.*

N.O.—Solanaceæ.

Habitat.—New South Wales and Queensland.

Characters.—Shortly petiolate, lanceolate, three to four inches long, three-fifths to one inch broad, narrowed at both ends, entire, midrib prominent, margin revolute; thin, smooth, inodorous, bitter,

Chemistry.—The alkaloid *duboisine* is present, with resin, protein, etc. Duboisine is a mydriatic alkaloid, probably a mixture of hyoscyamine and hyoscine. *Pseudo-hyoscyamine* ($C_{17}H_{23}NO_3$) is also present and is peculiar to this plant. The dried leaves contain 0·97 per cent. of total alkaloid.

Uses, etc.—As Belladonna, Stramonium, etc. The sulphate of the alkaloid finds occasional use in medicine.

Note.—Duboisia leichardtii also contains much alkaloid of a similar nature. D. hopwoodii is the source of the Australian narcotic stimulant *Pituri*, which contains an acrid liquid alkaloid, *piturine*, closely resembling, but not, as at one time supposed, identical with nicotine.

DIGITALIS FOLIA.—Digitalis Leaves.—The dried leaves of Digitalis purpurea, *Linn*, [*Bentl. and Trim. Med. Pl.* vol. iii. p. 195]. Collected from plants commencing to flower.

N.O.—Scrophulariaceæ.

Habitat.—Britain.

B.P. Characters.—From four to twelve inches (ten to thirty centimetres) or more in length, and sometimes as much as five or six inches (twelve and a half to fifteen centimetres) broad, with a winged petiole of varying length down which the lower veins are decurrent; broadly ovate or ovate-lanceolate, subacute, crenate or irregularly crenate-dentate. Upper surface somewhat rugose, dull green and slightly hairy, with glandular, simple, usually three-celled hairs; under surface paler and densely pubescent. The transverse section exhibits a mesophyll free from crystals of calcium oxalate. No marked odour, taste very bitter.

Note.—It has recently been stated that the first year's leaves are not much less active than those of the second year, while the result of physiological tests goes to prove that the leaves rapidly deteriorate on keeping and should not be used when more than a year old.

Chemistry.—The chemistry of Digitalis cannot be regarded as satisfactorily settled. It is probable that the glucosides *Digitalin* (Schmiedeburg, see below) and *Digitoxin* represent the therapeutic qualities of the drug. Digitalin reproduces the useful medicinal characteristics of Digitalis, while Digitoxin is highly toxic and cumulative. *Digitonin* and *Digiten* may be identical and in any case are practically inert, they have however the effect of rendering true Digitalin more soluble in water. *Digitalein* has not been established as a separate substance and probably consists largely of digitonin. Digitalin (Schmiedeburg) is soluble in alcohol, almost insoluble in water, sparingly soluble in ether and chloroform.

Uses, etc.—As cardiac tonic, diuretic, etc. *Dose.*—$\frac{1}{2}$ to $1\frac{1}{2}$ grains in powder.

B.P. Preparations.

Infusum Digitalis	- - -	1 part in 147.
Tinctura ,,	- - -	1 ,, 8 of alcohol (60 per cent.)

B.P.C. Preparations.—Infusum Digitalis Concentratum, Succus Digitalis, Digitalinum and Digitoxinum.

DIGITALIN.—Under this name at least four different substances occur in commerce, no one of which can safely be said to absolutely represent the drug from which it is obtained, nor to be fully reliable in its action, viz.—

1. *French Digitalin*, the amorphous product of Homolle.—This was formerly official in the B.P., and is said to be made up of a mixture of digitalin and digitoxin.

2. *Nativelle's Digitalin.*—This is the crystalline substance claimed by Nativelle to be the active principle of Digitalis, and for the isolation of which he obtained the prize of the French Academy. It is said to consist mainly of digitoxin with some digitalin.

3. *German Digitalin* is an amorphous substance soluble in water, and is said to consist chiefly of digitonin with some digitalin.

4. *Digitalin Verum.*—This is the name applied to the digitalin of Schmiedeburg; it is a white amorphous powder, and is said to consist entirely of digitalin; for this reason it is regarded as being the most reliable of the different substances bearing the name digitalin, and is included in the B.P.C. as Digitalinum.

Note.—ADULTERATIONS OF DIGITALIS LEAVES.—*Ploughman's spikenard*, the leaves of INULA CONYZA (*N.O.*—Compositæ), are rougher, less divided on their margins, and when bruised emit a fœtid odour.

Comfrey leaves (SYMPHYTUM OFFICINALE. *N.O.*—Boraginaceæ). The smaller veins do not extend into the wing of the petiole.

Great Mullein leaves (VERBASCUM THAPSUS. *N.O.*—Scrophulariaceæ) possess a woolly appearance on both sides, whereas the foxglove leaves are much less downy and on the under surface only.

ROSMARINUS.—Rosemary.—The leaves of Rosmarinus officinalis, *Linn.*

N.O.—Labiatæ.

Habitat.—Basin of the Mediterranean.

Characters.—About one inch long, rigid, linear, entire, revolute, dark-green above, woolly and glandular beneath; pungently aromatic, somewhat camphoraceous.

Chemistry.—Volatile oil (0·5 to 1 per cent.), a little tannic acid, resin, and bitter principle.

Uses, etc.—For the production of the oil. (*See* Oleum Rosmarini).

THYMUS.—Thyme.— The leaves of Thymus vulgaris, *Linn.*

N.O.—Labiatæ.

Habitat.—Europe; cultivated.

Characters.—The leaves are one-quarter to one-third of an inch long, ovate-oblong or linear, revolute margins, greyish green, glandular, punctate on both sides, and pubescent beneath, the upper ones bearing in their axils small clusters of whitish or reddish flowers, with exserted stamens.

Chemistry.—Volatile oil, about 2½ per cent. The oil contains *cymene* ($C_{10}H_{14}$), *thymene* or *pinene* ($C_{10}H_{16}$), and *thymol* and its isomer *carvacrol* ($C_{10}H_{14}O$). (*See* Thymol).

Uses, etc.—For the production of Oil of Thyme and thence of Thymol. Commercial Oil of Thyme is frequently sold under the name of Oil of Origanum, and is not infrequently more or less destitute of thymol.

Note.—*Wild thyme* (THYMUS SERPYLLUM) has similar properties to the above, and has been used in medicine as a stimulant and carminative.

SALVIA.—Sage.—The leaves of Salvia officinalis, *Linn.*

N.O.—Labiatæ.

Habitat.—Indigenous to Southern Europe.

Characters.—About two inches long, petiolate, ovate-oblong, obtuse, finely crenulate, thickish, wrinkled, greyish-green, soft, hairy, and glandular beneath; aromatic, bitterish, somewhat astringent.

Chemistry.—Yields volatile oil 0·5 to 1·0 per cent. when fresh, or about three times this quantity when dry. The S.G. of this is between 0·91 and 0·93; it contains *pinene*, *cineol*, and *thujone*, formerly known as *salviol* ($C_{10}H_{16}O$). Tannin and resin are also present in the leaves.

Uses, etc.—Stimulant, astringent. Official in the U.S.P. *Dose*.—15 to 60 grains in infusion.

Note.—Certain varieties of sage seeds are mucilaginous and nutritive; they are used in Mexico by the Indians as a food, under the title of *Chia*.

RUMEX ACETOSA.—Sorrel.—The leaves of Rumex acetosa, *Linn.*

N.O.—Polygonaceæ.

Syn.—Green sauce.

Habitat.—Britain.

Characters.—Alternate, oblong-sagittate, smooth on both sides, undulated at the margin; bright-green, lowermost petiolate-obtuse, with two lobes at the base turned backwards; upper smaller, sessile, acute; uppermost linear; the whole subtended by membranous, whitish, semi-tubular stipules.

Chemistry.—Tartaric and tannic acids are present, together with acid oxalate of potassium.

Uses, etc.—Refrigerant and diuretic. Formerly included in some of the Pharmacopœias.

Note.—R. Acetosella, Sheep-sorrel, has similar characters.

MATICÆ FOLIA.—Matico Leaves.—The dried leaves of Piper angustifolium, *Ruiz et Pavon* (Artanthe elongatum).

N.O.—Piperaceæ.

Habitat.—Peru.

Characters.—From about four to eight inches long, oblong-lanceolate, tapering towards the apex, cordate and unequal at the base, entire or minutely crenulate, greenish-yellow, very shortly petiolate, reticulated with sunken veins and tesselated above, the veins prominent beneath, and the depressions formed by them densely clothed with hairs. Taste aromatic, bitterish; odour pleasant, feebly aromatic. The leaves as commonly seen in commerce are more or less broken, folded and compressed into a brittle mass, and have mixed with them a variable proportion of the jointed stems, flowers and fruits.

Chemistry.—A small quantity of volatile oil, containing *Matico Camphor*; a crystallisable acid, called *artanthic acid*; a trace of tannic acid; and a little resin.

Uses, etc.—Aromatic, tonic and stimulant; the volatile oil has a styptic action. Formerly official in B.P. The B.P.C. includes a fluid extract, tincture and infusion. U.S.P. has a fluid extract. *Dose*, in powder.—30 to 120 grains.

BOLDO.—The leaves of Boldu Boldus, *Lyons* (Pneumus Boldus).

N.O.—Monimiaceæ.

Habitat.—Chili.

Characters.—Opposite, shortly petiolate or sessile, about two inches long, entire, reddish-brown when dry, coriaceous, with a prominent midrib and very numerous small glands on the surface; odour fragrant; taste aromatic and pungent.

Chemistry.—Contains an aromatic volatile oil (2 per cent.), containing eugenol, cumic aldehyde, and terpenes, a glucoside (*boldoglucin*), and an alkaloid (*boldine*, 0·1 per cent.), resin, tannin, etc.

Uses, etc. Nervous sedative and hypnotic, also as hepatic tonic. The B.P.C. and French Codex include a tincture.

Note.—Monimia rotundifolia, of Australia, has constituents and properties similar to Boldo.

LAURI FOLIA.—Sweet Bay Leaves.—The leaves of Laurus nobilis, *Linn.*

N.O.—Lauraceæ.

Habitat.—The Mediterranean shores.

Characters.—Three to four inches long, an inch or more broad, shortly petiolate, coriaceous, smooth, pellucid-punctate, oblong, or oblong-lanceolate, acute at both ends, entire, glossy above, veined beneath, and when dry of a yellowish or brownish-green colour, pleasant aromatic odour, and bitterish taste.

Chemistry.—By distillation a yellow-coloured volatile oil is obtained, having a S.G. of 0·91, and containing *cineol*, *eugenol*, etc., with hydrocarbons.

Uses, etc.—The volatile oil finds use as an ingredient of external applications for the skin, etc.

CASTANEA.—American Chestnut.—The leaves of Castanea dentata, *Borckh.*, collected in September or October whilst still green.

N.O.—Cupuliferæ.

Habitat.—United States, etc.

Characters.—From six to ten inches long, about two inches in width, petiolate, oblong-lanceolate, acuminate, mucronate, feather-veined, sinuate-serrate, smooth; odour slight; taste astringent.

Chemistry.—Tannin, 9 per cent., etc.

Uses, etc.—Tonic, sedative. *Dose.*—30 to 120 grains. Formerly official in the U.S.P. for the production of a fluid extract.

Note.—C. Castanea, the Spanish chestnut has also astringent properties.

6. FLOWERS.—FLORES.

Under this heading are included not only flowers proper, but parts of flowers (saffron) and groups of flowers or *inflorescences* (chamomile, cusso). The inflorescence most commonly met with in Materia Medica is the so-called *head* or *capitulum* of the Compositæ which consists of a globular cluster of sessile florets, some of which are usually modified for purposes other than that of reproduction, and surround the sexual flowers in a circle called the *ray*. The capitulum is usually bounded at its base by a number of scale-like leaves or *bracts* forming the *involucre*, whilst scattered amongst the florets are many similar but smaller scales, the *paleæ* or *chaff*.

The flower, which may be stalked (*pedunculate*) or stalkless (*sessile*), normally consists of the male and female reproductive organs of the plant (*stamens* and *pistil*), surrounded by two whorls of protective envelopes (*corolla* and *calyx*), the whole being borne on a more or less disc-like structure, the *thalamus* or *receptacle*. The stamen consists normally of the thread-like *filament*, carrying at its summit the *anther*, which bears the *pollen grains* or ultimate male elements. The pistil consists of one or more vessels (*carpels*), constituting the *ovary*, and carrying the ultimate female element or *ovule*; whilst attached to the ovary, either directly or by means of a thread-like prolongation (the *style*), is the pollen-receiving organ or *stigma*. The inner surrounding envelope or corolla of the flower is made up of a number of leaf-like, usually more or less brightly-coloured parts, the *petals*, whilst the outer envelope or *calyx* is similarly constituted, but is usually green in colour. The duration of both corolla and calyx is various, the terms *persistent*, *deciduous*, etc., being used, *e.g.*, the calyx of Labiates is persistent, commonly remaining unwithered until the fruit is matured, whilst that of some Papaveraceæ (corn-poppy) falls when the corolla unfolds.

The typical flower has the complete number of organs enumerated above, and these equal in number and alike in shape; but in the majority of cases there are to be found wide deviations from the typical arrangement. Various modifications are brought about by, *e.g.*, the union (*cohesion*) of members of the same whorl (*gamopetaly*, *gamosepaly*, etc.) or (*adhesion*) of members of contiguous whorls (*epipetalous* stamens); the suppression of some parts, as in flowers having calyx only, corolla only, etc.; irregularity in size or shape of members of the same circle; the existence of an increased number of members of the same circle, etc. Diœcious flowers, *i.e.*, flowers in which the male and female organs are born in different individuals, are also not infrequently met with.

Chemistry of Flowers.—The chemical principles characteristic of flowers belong for the most part to the classes of volatile oils, *e.g.*, lavender-flowers, orange-flowers, clove-buds, etc., and colouring matters (rose or red poppy petals), the presence of those substances being correlated with the special attractive functions of the flower. In a few instances (cousso, insect-flowers) active principles of a different nature are present.

RHŒADOS PETALA.—Red Poppy Petals.

—The fresh petals of Papaver Rhœas, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 19].

N.O.—Papaveraceæ.

Syn.—Corn Poppy.

Habitat.—Europe, North Africa, and Asia eastward to India.

B.P. Characters.—The fresh petals are of a bright scarlet colour; they are transversely elliptical in outline, about two inches (five centimetres) broad, have a smooth lustrous surface and an entire margin. The odour is characteristic, and somewhat unpleasant; taste slightly bitter.

Chemistry.—Morphine has been stated to be present to the extent of 0·1 to 0·7 per cent., but Hesse has more recently shown that Red Poppy Petals contain no morphine, but *rhœadine* ($C_{21}H_{21}NO_6$), a non-toxic alkaloid, gum, starch, albumin, fat, wax, and two deliquescent colouring principles, *rhœadic acid* (dark red) and *papaveric acid* (bright red), are also present.

Uses, etc.—Chiefly as a colouring agent.

B.P. Preparation.

Syrupus Rhœados - - - - - 1 in 4½ about.

AURANTII FLORES.—Orange Flowers.—

The flowers of Citrus Aurantium *var.* Bigaradia, *Hook, f.*

N.O.—Rutaceæ.

Habitat.—India; cultivated widely.

Characters.—These flowers contain a fragrant volatile oil, and are used for producing orange flower water, the bulk of which is imported from France.

B.P. Preparations—Aqua Aurantii Florum, *which is contained in* Syrupus Aurantii Florum, Mistura Olei Ricini, and Syrupus Calcii Lactophosphatis.

Note.—The essential oil, *Oleum Aurantii Florum*, (*Oleum Neroli*) has S.G. 0·870 to 0·880, and is soluble in all proportions of rectified spirit. It contains *limonene*, *linalool*, *linalyl acetate*, *geraniol*, etc., but owes its fragrance to the presence of the methyl ester of *anthranilic acid* (*o-amidobenzoic acid*). *Oil of petit grain* is obtained by distillation of the leaves and small unripe fruits of the bitter and sweet orange, it has S.G. 0·885 to 0·900, and contains a large proportion of esters, including those present in Neroli, but no anthranilic acid.

CUSSO.—Kousso.—The dried panicles of pistillate flowers of Brayera anthelmintica, *Kunth* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 102].

N.O.—Rosaceæ.

Habitat.—Abyssinia.

B.P. Characters—Usually in more or less cylindrical rolls from one to two feet (three to six decimetres) in length, composed of reddish panicles of pistillate flowers. The panicles are much branched, the branches arising from the axils of large sheathing bracts; they are more or less covered with hairs and glands. Flowers numerous, small, shortly stalked, mostly unisexual, with two roundish membranous veined bracts at the base of each. The calyx has reddish veins, is hairy externally, and consists of two alternating whorls each of five segments, the inner whorl being curved inwards over the young fruit and shrivelled. No marked odour, taste bitter and acrid.

Chemistry.—Contains *koussin* (*kosin*) 3 per cent., *kosotoxin* (*cosotoxin*), protokosin (*protocosin*), tannic acid, wax, gum, sugar, and 6·25 per cent. of an acrid resin. Kosin is yellowish, crystalline, tasteless, pearly, insoluble in water, soluble in alkalies, ether, alcohol, etc. It is not certain to which of the constituents of the drug the medicinal activity of the plant is to be attributed. Kosin is stated to produce better results when impure than when highly purified.

Uses, etc.—As anthelmintic and tænifuge. *Dose.*—$\frac{1}{4}$ to $\frac{1}{2}$ oz.

The *B.P.C.* includes an infusion.

Note.—Staminate flowers are probably inert and their admixture with the official drug should be guarded against. They are green in colour and easily recognisable in the entire condition.

ROSÆ GALLICÆ PETALA.—Red-rose Petals.—The fresh and dried unexpanded petals of Rosa gallica, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 104]. From cultivated plants.

N.O.—Rosaceæ.

Habitat.— Britain.

B.P. Characters.—Usually in little cone-like masses, or sometimes separate and more or less crumpled. The petals are velvety, of a deep purplish-red colour, which passes into brownish-yellow towards the base, odour fragrant, especially developed in drying; taste somewhat bitter, feebly acid, and astringent.

Chemistry.—Tannic and gallic acids, *quercitrin*, *quercetin*, glucose, and a trace of volatile oil are present. The colouring matter, which is of an acid nature, is turned green by alkalies.

Uses, etc.—As tonic and mild astringent. *Dose.*—15 to 60 grains in powder.

B.P. Preparations.

*Confectio Rosæ Gallicæ	-	1 part of fresh petals in 4.
Infusum Rosæ Acidum	-	1 part of dried petals in 40.
Syrupus Rosæ - - -	1	„ „ 23.

Contained in

Pilula Aloes Barbadensis, Pilula Aloes et Asafetidæ, Pilula Aloes Socotrinæ, Pilula Hydrargyri.

B.P.C. Preparations.—Extractum Rosæ Liquidum, Infusum Rosæ Acidum Concentratum and Mel Rosæ.

ROSÆ CENTIFOLIÆ PETALA.—Cabbage-rose Petals.—The fresh fully expanded petals of Rosa centifolia, *Linn.* From plants cultivated in Britain.

N.O.—Rosaceæ.

Habitat.—Britain.

Characters.—Large, thin, delicate, very fragrant, and with a sweetish, slightly astringent, bitterish taste. Both odour and taste are readily imparted to water.

Chemistry.—Malic acid, tartaric acid, tannic acid, colouring matter, fat, resin, sugar, mucilage, and volatile oil (*otto of rose*).

Uses, etc.—Chiefly for the production of rose water. They may be preserved, when in a fresh state, by the addition of common salt. Formerly included in the B.P. for the production of rose water, which is now ordered to be prepared from the "rose water of commerce" (from ROSA DAMASCENA).

CARYOPHYLLUM.—Cloves.—The dried flower buds of Eugenia caryophyllata, *Thunb.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 112].

N.O.—Myrtaceæ.

Habitat.—Molucca Islands (Amboyna, etc.); cultivated in Zanzibar, the West Indies, Ceylon, etc.

B.P. Characters and Test.—About five-eighths of an inch (fifteen millimetres) long, each consisting of a dark brown, wrinkled, subcylindrical, somewhat angular calyx tube, which tapers below and is surmounted by four thick, rigid, open teeth, between which are four paler imbricated petals enclosing numerous stamens and a single style. Odour strong, fragrant, and spicy; taste very pungent and aromatic. Cloves should emit oil when indented with the finger-nail. Incinerated they should not yield more than 7 per cent. of ash.

Chemistry.—Volatile oil 18 per cent. (*see* Oleum Caryophylli), *caryophyllin* ($C_{22}H_{32}O_2$, white crystalline, tasteless), *eugenin* ($C_{10}H_{12}O_2$, crystalline, isomeric with eugenol), tannic acid (13 per cent.), gum, resin, etc.

Uses, etc.—Stimulant, carminative. *Dose.*—5 to 10 grains. Also largely as a flavouring agent in the kitchen, etc.

B.P. Preparations.

Infusum Aurantii Compositum	1 part in 160.
„ Caryophylli	1 „ 40.
*Oleum Caryophylli	yield 15 to 20 per cent.
Pulvis Cretæ Aromaticus	1 part in 30.
„ „ „	cum Opio.

**Contained in*

Pilula Colocynthidis Composita.
„ „ et Hyoscyami.

The *B.P.C.* includes Infusum Caryophylli Concentratum, etc.

Note.—Mother cloves, Anthophylli, the fruits of the clove-tree, are ovate-oblong berries containing less volatile oil than the true drug. They contain large starch granules, by means of which their presence in ground cloves may be detected.

Royal cloves were certain monstrous cloves having abnormally increased floral envelopes.

Clove stalks contain from 4 to 6½ per cent. of volatile oil, and are used to adulterate ground cloves.

SAMBUCI FLORES.—Elder Flowers.—

The flowers of Sambucus nigra, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 137], separated from the stalks.

N.O.—Caprifoliaceæ.

Habitat.—Britain.

B.P. Characters.—Elder Flowers are small; calyx superior, five-toothed; corolla flat, rotate, deeply five-lobed, creamy-white, with five stamens inserted in the tube; anthers yellow. They have a slight bitter taste, and a sweet, faint, not altogether agreeable odour.

Chemistry.—The fragrance of the flowers is due to a little volatile oil, of a butyraceous consistence, and volatile acids.

Uses, etc.—For the production of the distilled water which is known on the Continent as *Eau de Sureau.*

B.P. Preparation.

Aqua Sambuci	10 pounds to 1 gallon.

Note.—The fresh leaves, warmed with fats, yield *Oleum Viride* and *Unguentum Viride*. The fresh flowers, by infusion in warm lard, produce *Unguentum Sambuci B.P.C.*; and the ripe fruit is used to prepare elder-wine, and to impart colour to wines.

ANTHEMIDIS FLORES.—Chamomile Flowers.—

The dried expanded flower-heads of Anthemis nobilis, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 154], collected from cultivated plants.

N.O.—Compositæ.

Syn.—Roman Chamomile.

Habitat.—Britain.

B.P. Characters.—About one-half to three-quarters of an inch (twelve to twenty millimetres) in diameter, hemispherical

in shape, white or nearly white in colour. The involucre is composed of several rows of oblong bracts with membranous margins; the receptacle is solid, conical, and densely covered with concave, blunt, narrow, scaly bracts; the florets are mostly ligulate and white. Chamomile Flowers have a strong aromatic odour and bitter taste.

Chemistry.—*Volatile oil*, 0·75 per cent. (*see* Oleum Anthemidis), resin, tannin (little), and *bitter principle* of a glucosidal nature.

Uses, etc.—Tonic and stomachic. *Dose.*—15 to 60 grains.

B.P. Preparations.

Extractum Anthemidis - - aqueous; yield, about 30 per cent.

Oleum Anthemidis (*used in preparing* Extract. Anthemidis).

B.P.C. Preparations.—Aqua Anthemidis, Extractum Anthemidis Liquidum, Infusum Anthemidis, Infusum Anthemidis Concentratum, Decoctum Anthemidis et Papaveris.

Note.—Substitutions and Adulterations.—The capitula of the *wild* or *German chamomile* (Matricaria chamomilla) may be distinguished by having a hollow receptacle, and its florets having no chaff (paleæ) around them. They are also less aromatic than the official kind. The double flowers of *feverfew* [Chrysanthemum (Pyrethrum) parthenium] have the florets arranged on a nearly flat receptacle, and the odour is unpleasant.

MATRICARIA.—German Chamomile.—The flower-heads of Matricaria Chamomilla, *Linn.*

N.O.—Compositæ.

Habitat.—Central Europe.

Characters.—About three-quarters of an inch broad, composed of a flattish, imbricate involucre, a conical, hollow, naked receptacle, about fifteen white, ligulate, reflexed ray florets, and numerous yellow, tubular, perfect florets, without pappus; strongly aromatic and bitter.

Chemistry.—Volatile oil (a quarter per cent.; different from oil of chamomile, but of doubtful composition, contains an odourless paraffin and a blue substance which has been termed *cærulein*), bitter extractive, and a little tannic acid.

Uses, etc.—Similar to chamomile. *Dose.*—15 to 60 grains in infusion. Official in the U.S.P.

Note.—The similar flower-heads of Anthemis arvensis and Anthemis cotula (*may-weed*), have a conical, solid, and chaffy receptacle.

CALENDULÆ FLORES.—Marigold Flowers.—The florets of Calendula officinalis, *Linn.*

N.O.—Compositæ.

Habitat.—South Europe.

Characters.—Florets about half-an-inch long, linear and strap-shaped, delicately veined in a longitudinal direction, yellow or orange-coloured, three-toothed above, the short hairy tube enclosing the remnants of a filiform style, terminating in two elongated branches; odour slight and somewhat heavy; taste bitterish and somewhat saline.

Chemistry.—*See* Calendula (under Herbs).

Uses, etc.—Stimulant, and for outward application (in the form of tincture) to bruises, etc. The U.S.P. and B.P.C. have a tincture, 1 in 5.

ARNICÆ FLORES.—Arnica Flowers.—The flower-heads of Arnica montana, *Linn.*

N.O.—Compositæ.

Habitat.—Central Europe.

Characters.—About one and a fifth inch broad, depressed-roundish, consisting of a scaly involucre in two rows, and a small, flat, hairy receptacle, bearing about sixteen yellow strap-shaped ray-florets, and numerous, yellow, five-toothed, tubular disk-florets, having slender, spindle-shaped achenes (cypselæ), crowned by a hairy pappus. It has a feeble, aromatic odour, and a bitter acrid taste.

Chemistry.—A butyraceous volatile oil, several resins, one insoluble in ether and *arnicin*, which is found also in the rhizome.

Uses, etc. Similar to the root. Official in the B.P.C. and U.S.P. for the production of a tincture.

SANTONICA.—Santonica.—The dried unexpanded flower-heads or capitula of Artemisia maritima, *var.* Stechmanniana, *Besser* (Artemisia pauciflora).

N.O.—Compositæ.

Syn.—Wormseed, Semen contra, Semen cinæ.

Habitat.—Turkestan.

Characters.—About one-tenth of an inch in length, oblong-ovoid, obtuse, pale greenish-brown, nearly smooth; resembling seeds in appearance, but consisting of from twelve to eighteen imbricated involucral scales, with a broad, thick, yellowish-green midrib, enclosing three to five somewhat tubular florets. Odour, more especially when rubbed, strong, peculiar, and somewhat camphoraceous; taste bitter and camphoraceous.

Chemistry.—Volatile oil (2 or 3 per cent., composed of *cineol* and a *terpene*) *santonin* (2 to 3·5 per cent.), resin, *artemisin* (crystalline, probably hydroxy-santonin), sugar, and ash (6·5 per cent.), rich in silica.

Uses, etc.—As anthelmintic; for making Santonin; formerly official. An ethereal extract (*Extractum Cinæ*) is official in some of the Continental Pharmacopœias.

Santoninum P.B.—Santonin, $C_{15}H_{18}O_3$, the active principle of Santonica is mainly produced at Tschimkent in Turkestan, but may be obtained by treating the drug with lime, and decomposing the compound thus formed with hydrochloric acid. It is obtained in the form of flat rhombic prisms, feebly bitter, fusible and sublimable, sparingly soluble in water, soluble in 40 parts of rectified spirit, in 4 of boiling rectified spirit, and in 2 parts of chloroform. It is not dissolved by dilute mineral acids; becomes yellow on exposure to light, leaves no residue when burned with free access of air, and when added to warm alcoholic solution of potash, yields a violet-red colour. Santonin is the anhydride of *santoninic acid* ($C_{15}H_{20}O_4$), and is peculiarly susceptible to the action of sunlight, by which it is decomposed into *photosantonic acid*.

Dose.—2 to 5 grains.

B.P. Preparation (of Santonin).

Trochisci Santonini - - - - 1 grain in each.

Note.—Adulterations of Santonica.—The unexpanded flower-heads of Artemisia glomerata (*Barbary wormseed*) have generally more of the flower-stalk attached than the Russian, and are covered with minute hairs. This and the East Indian variety are worthless, since they contain no santonin. Those of Artemisia vulgaris (*mugwort*) and of Artemisia absinthium (*which see*) are round.

PYRETHRI FLORES.—Insect Flowers.—The dried flower-heads of Pyrethrum (Chrysanthemum) cinerariæfolium, *Visiani* (obtained from Dalmatia), P. roseum, P. carneum (obtained from the Caucasus), etc.

N.O.—Compositæ.

Habitat.—Caucasus, Austria, etc.

Characters.—The capitulum usually consists of a pale greyish-green epicalyx, enclosing numerous florets, the outer two or three whorls of which are nearly white and ligulate, the inner yellow and tubular. The florets are inserted upon a slightly convex (but not conical), solid, receptacle; odour peculiar and somewhat narcotic.

Both "closed" and "open" flowers are met with in commerce. The former are fully developed flowers, having the bracts of the involucre more or less erect. The "open" flowers often retain no ligulate or tubular corollas.

Chemistry.—Volatile oil, 0·5 to 1·25 per cent. (inert), and the active principle, a resin known as *pyrethro-toxic acid*. The amount of *oleo-resinous extractive*, yielded to ether, may be taken as a measure of the value of insect powder, and this should range from 5 to 8 per cent. or more and should be practically free from chlorophyll. Adulteration of the powder with other portions of the plant may be detected by an estimation of the oleo-resin, since the flowers alone contain this, the active constituent.

Uses, etc.—As insecticide in the form of powder; the "closed" Dalmation variety is preferred.

The *B.P.C.* includes a tincture of the flowers.

Note.—Persian insect flowers, from Chrysanthemum coccineum, were formerly imported. They are much less active than the Dalmatian variety.

CARTHAMUS.—Safflower.—The florets of Carthamus tinctorius, *Linn.*

N.O.—Compositæ.

Habitat.—Indigenous to India; cultivated.

Characters.—About four-fifths of an inch long, tubular, with divided limb; the tube of the anther is about one-fifth of an inch long; it protrudes from the throat, and is surmounted by the long, filiform, yellow style. Colour at first yellow, but becomes red, and, when dry, is brownish-red. Odour disagreeable; taste bitterish.

Chemistry.—*Carthamin* or *carthamic acid*, a red colouring matter, also *safflor* a yellowish colouring matter, on which the value of safflower as a dye, depends.

Uses, etc.—As colouring agent; sometimes used as an adulterant of saffron.

LAVANDULA.—Lavender.—The flowers of Lavandula vera, *D.C.*

N.O.—Labiatæ.

Habitat.—The Coasts of Mediterranean, cultivated in England at Hitchin and Mitcham.

Characters.—Calyx tubular, blue-grey, hairy, five-toothed, the upper tooth largest and roundish-rhomboid; corolla violet-blue, hairy and glandular on the outside, tubular and two-lipped, the upper lip two-lobed, the lower lip three lobed; stamens four, short, on the corolla tube; odour fragrant; taste bitterish, aromatic, somewhat camphoraceous.

Chemistry.—Volatile oil (1·5 per cent.); *see* Oleum Lavandulæ.

Uses, etc.—For producing the oil.

Note.—Lavandula spica (*spike lavender*).—The flowers of this plant have linear bracts, while those of the above are rhomboidal; by distillation they yield *oil of spike lavender.*

Lavandula stœchas.—Has a flower-spike mounted on a short stalk and terminating in two or three conspicuous purple bracts. The flower heads were formerly found in commerce under the name of *Flores Stœchados.*

CROCUS.—Saffron.—The dried stigmas and tops of the styles of Crocus sativus, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 274].

N.O.—Iridaceæ.

Syn.—Hay Saffron.

Habitat.—South Europe and South West Asia, cultivated in Spain, France, Italy, India, etc.

B.P. Characters and Tests.—Each entire portion of commercial saffron is an inch (twenty-five millimetres) or somewhat more in length, and consists of three orange-red stigmas, thickened and tubular above, jagged or notched at the upper extremities, and united below to the top of the yellow style. Saffron is flexible and unctuous to the touch, unless quite dry; it has a peculiar strong aromatic odour, and a bitter somewhat aromatic taste. Rubbed on the wet finger it leaves an intense orange-yellow tint. When pressed between folds of white filtering paper, it leaves no oily stain. When a small portion is placed in a glass of warm *water* it colours the liquid orange-yellow, becomes itself paler in colour, and does not deposit any white or coloured powder. Incinerated with free access of air, dried Saffron does not deflagrate (absence of nitrates), and yields about 7 per cent. of ash. It should not lose more than 12·5 per cent. of moisture when dried at 212° F. (100° C.).

Chemistry.—Volatile oil (not acrid, heavier than water), fixed oil, wax, mucilage, sugar, and *crocin (polychroite)* $C_{44}H_{70}O_{28}$. Crocin, the colouring principle, is a glucoside, easily soluble in water and dilute alcohol; by mineral acids it is resolved

into *crocetin* (red) and a sugar (*crocose*). A bitter principle, *saffron bitter* or *picro-crocin* is also said to be present.

Uses, etc.—Has a slightly stimulant action; chiefly used for the purposes of a colouring agent; formerly contained in Tincture of Rhubarb.

B.P. Preparations.

Decoctum Aloes Compositum	1 part in 200.
Tinctura Cinchonæ Composita	1 ,, 160.
Tinctura Croci	1 part in 20 of alcohol (60 per cent).

The *B.P.C.* includes Syrupus Croci, Tinctura Opii Crocata, Glycerinum Croci, etc.

Adulterations.—The following list includes the more commonly found adulterants: An excessive proportion of the yellow styles; the anthers of Crocus sativus; the florets of *safflower* (see below), *arnica* and *marigold*; exhausted stigmata of Saffron, which, of course, would possess little, if any, colouring power, but which may have been subsequently dyed; shreds of smoked beef, which would be detected when heated with soda lime, when a strong odour of ammonia would be evolved; inorganic matter, such as sulphates of barium and calcium; chalk, these being fixed by means of gum, glycerine, or glucose. Ammonium nitrate has been met with, it does not increase the ash but causes deflagration on ignition. The moisture is not infrequently abnormal; it should not be more than about 12 per cent. *Cake saffron* (*Crocus in placenta*) consists of safflower florets made into cakes with treacle, mucilage, or some similar sticky liquid. *Alicante Saffron* is usually grossly adulterated with mineral matter.

ZEA.—Zea.—The styles and stigmas of Zea Mays, *Linn.*

N.O.—Graminaceæ.

Syn.—Stigmata Maydis, Corn-silk.

Habitat.—Tropical America; cultivated.

Characters.—Thread-like; about six inches long and one-fiftieth of an inch broad, yellowish or greenish when fresh, red-brown when dry, soft-silky, finely hairy, inodorous, taste sweetish.

Chemistry.—Sugar, mucilage, protein, etc., and *maizenic acid*.

Uses, etc.—Diuretic and mild stimulant. Official in the U.S.P. and the B.P.C, the latter including a liquid extract.

7. HERBS.—HERBÆ.

The drugs which are included under this head may, as in the case of Chiretta, consist of the whole plant, but, more frequently, the term herb is applicable to the young upper part of the plant, consisting of the more or less succulent shoots, with the attached leaves and flowers. A complete description of a flowering herb will thus include mention of the form of the stem, with its method of branching; the character of the leaves and the method of their arrangement upon the stem; the nature of the inflorescence and of the flowers which go to make it up.

A few drugs such as Hyoscyamus partaking to some extent of the nature of *herbs* have already been described under *leaves*.

ADONIS.—Adonis.—The herb of Adonis vernalis, *Linn.*, A. æstivalis, *Linn.*, and A. autumnalis, *Linn.*

N.O.—Ranunculaceæ.

Habitat.—Europe and Asia.

Characters.—The plant is about ten inches long; leaves bright green in colour, pinnately divided into numerous narrow segments, and, in the case of A. vernalis, pubescent. Flowers of A. vernalis, golden red in colour; of A. æstivalis, yellowish-red; of A. autumnalis, crimson.

Chemistry.—*Picradonidin* (*adonidin*), which is an amorphous glucoside, and *adonite* (Merck), a crystalline, pentatomic alcohol ($C_5H_{12}O_5$), converted, by oxidising agents, into *ribose* ($C_5H_{10}O_5$).

Uses, etc.—As cardiac tonic, similar in action to digitalis, but non-cumulative. Given in infusion, fluid extract, etc. The commercial *adonidin* is probably a mixture of the active principle with other constituents of the plant. It is given in doses of $\frac{1}{3}$ grain.

PULSATILLA.—Pulsatilla.—The herb of Anemone pulsatilla, *Linn.*, and of Anemone pratensis, *Linn.*, collected soon after flowering. It should be carefully preserved, and not kept longer than one year.

N.O.—Ranunculaceæ.

Syn.—Pasque flower.

Habitat.—Indigenous to Central and Northern Europe.

Characters.—Leaves radical, petiolate, silky villous, twice or thrice deeply three-parted or pinnately cleft, with linear, acute lobes, appearing after the large purple flowers; inodorous, very acrid.

Chemistry.—A very acrid yellow oil, obtained by distillation with water, and which becomes rapidly changed into *anemonin* (colourless, crystalline) and *isoanemonic acid*.

Uses, etc.—Much used by homœopathic practitioners; said to be diuretic and expectorant; formerly included in the U.S.P.

The *B.P.C.* has Tinctura Pulsatillæ and Liquor Caulophylli et Pulsatillæ.

RANUNCULUS FICARIA.—Pilewort.—The fresh herb of Ranunculus Ficaria, *Linn.*, collected while in flower.

N.O.—Ranunculaceæ.

Syn.—Lesser Celandine, Ficaria.

Habitat.—Britain.

Characters.—Herb about three to eight inches high; leaves, cordate, petiolate, crenate; flowers, yellow, about one inch across; roots with fasciculate knobs.

Chemistry.—An acrid constituent, but nothing is known definitely of the composition of pilewort.

Uses, etc.—In the form of ointment or suppository of the fresh herb for piles, formulæ for these being included in the B.P.C.

CHELIDONIUM.—Greater Celandine.—The herb of Chelidonium majus, *Linn*

N.O.—Papaveraceæ.

Habitat.—England.

Characters.—Stem about two feet high, branching; leaves alternate, petiolate, oblong or oval, lyrately pinnatifid or pinnate. Flowers on long peduncles, with two sepals, and four yellow petals. Fruit, a long, linear, one-celled capsule. Seeds, many crested. The whole plant contains a saffron-coloured latex.

Chemistry.—Five alkaloids are said to be present, viz., *chelidonine*, *chelerythrine*, *α-homochelidonine*, *β-homochelidonine*, and *protopine*. In addition to these, two acids, viz., *chelidonic* and *chelidoninic*, are described, and also a body named *chelidoxanthin*, a neutral bitter principle.

Uses, etc.—Diuretic, cathartic. *Dose*—15 to 60 grains. Formerly official in the U.S.P. The juice of the plant is a popular external application for warts.

HELIANTHEMUM.—Helianthemum.—The herb of Helianthemum canadense, *Michaux*, and of Helianthemum corymbosum, *Michaux*.

N.O.—Cistaceæ.

Syn.—Frost-wort, rock-rose.

Habitat.—North America.

Characters.—About twelve inches high; stem rigid, slender, hairy; leaves alternate, elliptic or linear-lanceolate, about four-fifths of an inch long, woolly beneath; flowers single, with five large petals, or in clusters, nearly sessile and apetalous; inodorous, bitter, astringent.

Chemistry.—Tannin, a glucoside, sugar, gum, wax, etc.

Uses, etc.—Tonic, astringent. *Dose.*—8 to 30 grains in decoction.

VIOLÆ HERBA.—Pansy.—The wild-grown flowering herb of Viola tricolor, *Linn.*

N.O.—Violaceæ.

Habitat.—Europe.

Characters.—Stem angular and nearly smooth, leaves alternate, ovate, crenate, petiolate, and with large foliaceous stipules; flowers spurred, inodorous; taste bitter and acrid.

Chemistry.—A glucoside, *violaquercitrin*, mucilage, sugar, salicylic acid, bitter principle, resin, etc.

Uses, etc.—Alterative, expectorant. *Dose.*—15 to 16 grains; formerly official in the U.S.P.

HYPERICUM.—**Hypericum.**—The herb of Hypericum perforatum, *Linn.*

N.O.—Hypericinacæ.

Syn.—St. John's Wort.

Habitat.—Europe and Asia.

Characters.—Erect, about twenty inches high, smooth; stem somewhat two-edged, leaves opposite, sessile, linear-oblong, pellucid-punctate; flowers about four-fifths of an inch broad, in terminal cymes, yellow, black dotted; odour slight, balsamic; taste acrid, bitter.

Chemistry.—Resin, tannin, and red colouring matter.

Uses, etc.—An old-fashioned domestic remedy, now more or less obsolete. *Oleum hyperici* (*red oil*) is prepared by macerating the herb in olive oil.

LINUM CATHARTICUM.—**Purging Flax.**—The herb of Linum catharticum, *Linn.*

N.O.—Linaceæ.

Habitat.—Europe.

Characters.—Stem six to eight inches in height, dichotomous near the summit, with opposite, obovate-lanceolate, entire leaves, and minute white flowers having obovate acute petals. Taste bitter, acrid.

Chemistry.—*Linin*, a neutral, colourless, crystalline principle, of a persistently bitter taste, possesses no purgative properties and is probably an hydrolytic product of an active glucoside.

Uses, etc.—As cathartic, etc. *Dose.*—60 grains in powder.

SCOPARII CACUMINA.—Broom Tops.—

The fresh and the dried tops of Cytisus scoparius, *Link.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 70].

N.O.—Leguminosæ.

Syns.—Genista Scoparia; Spartium Scoparium.

Habitat.—Britain, Europe, West Asia, etc.

B.P. Characters.—The stem is dark green, with long, straight, slender, alternate branches; the latter, like the upper part of the stem, are winged, tough, flexible, and glabrous. The leaves, when present, are small, sessile, and simple above, stalked and trifoliate below. The taste is bitter and nauseous; the odour of the fresh tops, especially when bruised, is characteristic, but when dry the drug is almost odourless.

Chemistry.—*Scoparin*, $C_{21}H_{22}O_{10}$ (a diuretic principle), and the volatile alkaloid, *sparteine*, $C_{15}H_{26}N_2$. Volatile oil, tannin, fat, sugar, etc., are also present. Sparteine is a colourless

liquid heavier than water, in which it is only slightly soluble. It neutralizes acids, and behaves in all ways as an alkaloid. From it, by oxidation, are formed oxy-, dioxy-, and trioxy-sparteine; by reduction, hydro-sparteine ($C_{15}H_{28}N_2$) is obtained.

Uses, etc.—Diuretic and cathartic.

B.P. Preparations.

Infusum Scoparii - - -	from dried tops, 1 in 10.
Succus Scoparii - - -	from herb.

B.P.C. Preparations.—Decoctum Scoparii, Infusum Scoparii Concentratum.

Preparations other than B.P.—*Sparteina* B.P.C. (the alkaloid) forms certain salts, of which the sulphate (official in the B.P.C. and U.S.P.) is most used in medicine. *Sparteine Sulphate* ($C_{15}H_{26}N_2.H_2SO_4,5H_2O$) occurs in colourless crystals, readily soluble in water. *Dose.*—$\frac{1}{8}$ to 2 grains

Note.—*Cytisine* ($C_{11}H_{14}N_2O$) is an alkaloid obtained from various leguminous plants, viz., *Laburnum* [CYTISUS LABURNUM (Laburnum vulgare)], *Gorse* (ULEX EUROPŒUS), in which latter it is known as *Ulexine*, etc. It has a poisonous action, and has been recommended in whooping cough and asthma.

MELILOTUS.—Melilot.—The herb of Melilotus officinalis, *Lam.*, and M. albus, *Desv.*

N.O.—Leguminosæ.

Syn.—Sweet clover.

Habitat.—Europe.

Characters.—Erect, about four feet high, smooth, much branched, leaves alternate, trifoliate; leaflets oval or obovate-oblong, sharply serrate, near the base, entire; flowers small, yellow or white, racemose; legume small, wrinkled; odour fragrant; taste aromatic, somewhat pungent and bitter.

Chemistry.—*Coumarin*, *melilotol* (a fragrant volatile oil), *coumaric acid* ($C_9H_8O_3$), *hydrocoumaric* (*melilotic*) *acid* ($C_9H_{10}O_3$).

Uses, etc.—An old-fashioned remedy for rheumatism, now practically obsolete.

CACTUS.—Cactus.—The herb of Cactus (Cereus) grandiflorus, *Linn.*, the night-blooming Cereus.

N.O.—Cactaceæ.

Habitat.—Tropical America.

Characters.—Stem branching, fleshy green, with five or six angles, beset with clusters of five or six short radiating spires. Calyx lobes linear, acute, brownish, inner ones yellow. Flowers fragrant, night-blooming. Fruit orange-coloured, of the size of an egg.

Chemistry.—*Cactine*, a supposed alkaloid has been described, more recent analysis has shown the absence of alkaloid.

Uses, etc.—Has been tried in neurasthenia, angina pectoris, low fever, etc., and as a substitute for digitalis in cardiac disease. Used by natives in dropsy. Given in tincture, fluid extract. *Dose.*—(of latter) 10 minims.

EPILOBIUM.—Epilobium.—The herb of Chamœnerion angustifolium, *Scop.*

N.O.—Onagrariaceæ.

Syn.—Willow herb.

Habitat.—Northern hemisphere.

Characters.—Erect, smooth, about forty inches high; leaves sub-sessile, alternate, lanceolate, pointed, nearly entire, pale-green beneath; inflorescence racemose; taste mucilaginous, astringent.

Chemistry.—Mucilage, tannin, etc.

Uses, etc.—Astringent. *Dose.*—30 to 60 grains.

GALIUM.—Goose Grass.—The herb of Galium Aparine, *Linn.*

N.O.—Rubiaceæ.

Syn.—Cleavers.

Habitat.—Northern hemisphere.

Characters.—Stem climbing, quadrangular, retrorsely prickly; leaves in whorls of six to eights, linear-lanceolate, with mucronate margins and rough midribs; fruit two-seeded, covered with hooked bristles; inodorous; taste saline, somewhat astringent and bitter.

Chemistry.—*Gali-tannic acid, rubichloric acid,* etc.

Uses, etc.—As diuretic and antiscorbutic. *Dose.*—30 to 60 grains in infusion. The fresh juice is also used.

Note.—Allied Species.—Galium verum (*cheese rennet*) contains the same principles as the above, and is sometimes used for colouring cheese, etc. G. tinctorium is used for dyeing purposes by the Indians. G. triflorum contains coumarin.

MITCHELLA.—Mitchella.—The dried stem and leaves of Mitchella repens, *Linn.*

N.O.—Rubiaceæ.

Syn.—Squaw Vine.

Habitat.—North America.

Characters.—Slender stems, one to two feet in length, with opposite, deep green, shortly petiolate leaves, one-third to half-an-inch long, and ovate in shape.

Chemistry.—A saponin is present, but no other definite constituent has been isolated.

TUSSILAGO.—Coltsfoot.—The dried herb of Tussilago Farfara, *Linn.*

N.O.—Compositæ.

Habitat.—Britain, Europe, and North Asia.

Characters.—A perennial herb with creeping root, which early in spring sends up several erect, simple, unifloral scapes or flower-stems, five to six inches high, bearing adpressed scale-like bracts of a brownish-pink colour. The flower, which stands singly at the end of the scape is large, yellow, compound, with hermaphrodite florets in the disk, and female florets in the ray. The latter are numerous, linear, and twice the length of the former. The leaves appear after the flowers have blown. They are radical, petiolate, large, cordate, angular, toothed at the margin, bright green upon the upper surface, white and downy beneath.

Chemistry.—Mucilage, bitter amorphous glucoside, tannin, etc.

Uses, etc.—Demulcent, tonic. *Dose.*—30 to 60 grains. Usually given in decoction or as Syrupus Tussilaginis B.P.C.

GRINDELIA.—Grindelia.—The leaves and flowering tops of Grindelia robusta, *Nuttall*, and G. squarrosa, *Dunal*.

N.O.—Compositæ.

Syn.—Californian gum plant.

Habitat.—North America

Characters.—The two species are very similar in character. Leaves about two inches or less long, varying from broadly spathulate or oblong to lanceolate; sessile or clasping, obtuse, more or less sharply serrate; colour, greenish-brown (Robusta), pale-yellow (Squarrosa), smooth, finely dotted, brittle; heads many flowered; the involucre hemispherical, about half-an-inch broad, composed of numerous imbricated, squarrosely tipped bracts (G. squarrosa), adpressed bracts (G. robusta); ray-florets yellow, ligulate, pistillate; disc-florets yellow, tubular, perfect; pappus consisting of about three awns of the length of the disc-florets; odour balsamic; taste, pungently aromatic and bitter.

Chemistry.—Resin, a glucoside allied to saponin, and a small quantity of alkaloid, *grindeline*.

Uses, etc.—Sedative in asthma, etc. *Dose.*—15 to 30 grains. Official in the Indian and Colonial Addendum and in the U.S.P. for the production of a fluid extract.

Note.—The Grindelia of commerce has recently been referred to G. CAMPORUM.

ABSINTHIUM.—Wormwood.—The leaves and tops of Artemisia Absinthium, *Linn.*

N.O.—Compositæ.

Habitat.—Northern Africa and Europe.

Characters.—Leaves about two inches long, hoary, silky-pubescent, petiolate, roundish-triangular in outline, pinnately two or three-cleft, with the segments lanceolate, the terminal one spathulate, bracts three cleft or entire; heads numerous, subglobose, with numerous small, pale yellow florets, all tubular and without pappus; odour aromatic; taste persistently bitter.

Chemistry.—Volatile oil (1·5 per cent., consisting chiefly of *absinthol* [*thujone*] $C_{10}H_{16}O$), *absinthin* (a crystalline bitter principle), bitter resin (2·5 per cent.), and green resin (5 per cent.)

Uses, etc.—Tonic, febrifuge. *Dose.*—15 to 60 grains in tincture, etc. Official in several of the Continental Pharmacopœias, formerly so in the U.S.P. The volatile oil is the active ingredient of the French liqueur, *absinthe*.

CALENDULA.—Marigold.—The fresh flowering herb of Calendula officinalis, *Linn.*

N.O.—Compositæ.

Habitat.—South Europe.

Characters.—Stem somewhat angular, rough; leaves alternate, thickish, hairy, spathulate or oblanceolate, slightly toothed, the upper ones sessile; flower heads nearly two inches long, the yellow strap-shaped, ray-florets in one or several rows, fertile, the achenes incurved and muricate; odour slightly narcotic; taste bitter and saline.

Chemistry.—*Calendulin* (a carbohydrate), and an amorphous bitter principle, etc.

Uses, etc.—Stimulant, vulnerary, etc. *Dose.*—8 to 30 grains; formerly official in the U.S.P.

EUPATORIUM.—Thoroughwort.—The leaves and flowering tops of Eupatorium perfoliatum, *Linn.*

N.O.—Compositæ.

Syn.—Boneset.

Habitat.—Canada and the United States of America.

Characters.—Leaves opposite, united at base, lanceolate, from four to six inches long, tapering, crenately-serrate, rugosely veined, rough above, downy and resinous-dotted beneath; flower-heads corymbose, numerous, with an oblong involucre of lance-linear scales, and with from ten to fifteen white florets having a bristly pappus, in a single row; odour weak and aromatic; taste astringent and bitter.

Chemistry.—Volatile oil, some tannic acid, and *eupatorin* a bitter glucosidal principle.

Uses, etc.—Stimulant, laxative, diaphoretic, etc. *Dose.*—30 to 60 grains; official in the U.S.P. for the production of a fluid extract.

ERIGERON.—Flea-bane.—The flowering herb of Erigeron canadense, *Linn.*

N.O.—Compositæ.

Habitat.—Canada and United States of America.

Characters.—Stem bristly, hairy, erect, and much branched; leaves linear-lanceolate, hairy, and mostly entire; capitula small, numerous, with a cylindrical involucre, many capillary ray-florets which are nearly included in the involucre, and a straw-coloured, bristly pappus; aromatic odour, and bitterish, somewhat acrid and astringent taste.

Chemistry.—The chief constituent is the volatile oil, largely *d-limonene*. It is a pale-yellow liquid, becoming darker and thicker by age and exposure to air; having a peculiar, aromatic, persistent odour; an aromatic, slightly pungent taste, and a neutral reaction. S.G., about 0·864. It is readily soluble in alcohol.

Uses, etc.—Stimulant, diuretic, etc. *Dose.*—30 to 60 grains in infusion. The oil is included in the U.S.P.

Note.—Allied Species.—E. philadelphicum, E. annuum, E. strigosum have similar constitution and properties.

ACHILLEA.—Yarrow.—The herb of Achillea millefolium, *Linn.*

N.O.—Compositæ.

Syn.—Millefoil.

Habitat.—Europe, Asia, indigenous.

Characters.—Erect, hairy; leaves nearly sessile, lanceolate, glandular beneath; from two to ten inches long, tri-pinnatifid, with linear-spathulate-toothed segments; flower-heads corymbose with an oblong imbricate involucre, flat, chaffy receptacle, and five rays; odour somewhat chamomile-like; taste bitter, aromatic.

Chemistry.—Volatile oil, resin, *achilleine* (bitter alkaloid; soluble in water), tannin and *achilleic* (aconitic) *acid*.

Uses, etc.—Stimulant, emmenagogue. *Dose.*—30 to 60 grains in infusion.

TANACETUM.—Tansy.—The leaves and tops of Tanacetum vulgare, *Linn.*

N.O.—Compositæ.

Habitat.—Europe.

Characters.—Leaves about six inches long, bipinnatifid; the segments oblong, obtuse, serrate or incised, smooth, dark green and glandular; flower-heads, corymbose, with an imbricated involucre, a convex, naked receptacle, and numerous yellow, tubular florets.

Chemistry.—*Tanacetin*, tannic acid, volatile oil (0·2 to 0·3 per cent. mainly *thujone*); waxy, resinous, and protein bodies, with sugar and vegetable acids.

Uses, etc.—Stimulant, emmenagogue, diuretic, etc., a violent irritant in large doses. *Dose.*—15 to 60 grains in infusion. Formerly included in the U.S.P.

CARDUUS BENEDICTUS.—Blessed Thistle.—The herb of Cnicus benedictus, *Linn.*

N.O.—Compositæ.

Habitat.—South Europe.

Characters.—Erect, somewhat woolly; leaves sessile above, and somewhat decurrent, alternate, lance-oblong, sinuately-lobed, soft spiny; flower-heads ovate, about an inch long, with an imbricate spinously-pointed involucre and a flat receptacle; odour slight, disagreeable; taste bitter.

Chemistry.—Volatile oil, tannin, and *cnicin* $C_{42}H_{56}O_{15}$. Cnicin is a bitter, crystalline, neutral body, soluble in alcohol, and slightly also in water; it is said to be analogous to salicin in its properties.

Uses, etc.—As diaphoretic and tonic. *Dose.*—15 to 60 grains.

Note.—The fruits of Silybum Marianum, the Mary Thistle, have similar properties and uses.

LACTUCA.—Lettuce.—The flowering herb of Lactuca virosa, *Linn.*

N.O.—Compositæ.

Syn.—Acrid lettuce.

Habitat.—Europe.

Characters.—Stem from two to four feet in height, erect, prickly near the base, above smooth and divided into branches; lower leaves large, oblong-ovate, undivided, toothed, commonly prickly on the underside of the midrib, sessile, and horizontal; upper leaves smaller, clasping, and often lobed; bracts cordate and pointed; flowers numerous, sulphur yellow, panicled; odour strong, opium-like; taste bitterish and acrid.

Chemistry.—In addition to the substances commonly found in herbs, strong-scented lettuce contains a minute quantity of mydriatic alkaloid (Farr and Wright); this is probably present only in the older plants. The full-grown herb contains much latex, which constitutes the greater part of the commercial *lactucarium* (*see Lactucarium*).

Uses, etc.—As mild sedative, and chiefly as a source of lactucarium; formerly official for the preparation of a green extract (now included in the B.P.C.).

Note.—The common garden lettuce (LACTUCA SATIVA) is also said to contain mydriatic alkaloid, but in still less quantity than the above; it also yields a relatively smaller proportion of lactucarium.

LOBELIA.—Lobelia.—The dried flowering herb of Lobelia inflata, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 162].

N.O.—Campanulaceæ.

Syn.—Indian Tobacco.

Habitat.—North America.

B.P. Characters.—The stems are angular, channelled, and furnished with narrow wings. They are often of a purplish tint, and bear one-celled hairs and the scars of alternate leaves. The leaves are irregularly toothed and hairy. The capsules are inflated, two-celled, and, when mature, contain minute, oblong, reticulated, brown seeds. The transverse section of the stem exhibits laticiferous vessels in the bast. Odour somewhat irritating; taste at first not marked, but, after chewing, burning and acrid.

Chemistry.—An alkaloid, *lobeline* ($C_{18}H_{23}NO_2$), in combination with *lobelic acid*, volatile oil, fixed oil, and a neutral substance called *inflatin*. Lobeline is a non-volatile alkaloid, obtainable in the form of an oily liquid, and forming crystallizable salts with mineral acids. The so-called *lobelacrine*, formerly considered to be the acrid principle, is probably lobelate of lobeline.

Uses, etc.—Anti-spasmodic, expectorant, diaphoretic, etc.

B.P. Preparations.

Tinctura Lobeliæ Ætherea - -	1 part in 5 of spirit of ether.

B.P.C. Preparations.—Pulvis Lobeliæ Comp., Pulvis Stramonii Comp., Tinctura Lobeliæ (formerly official).

Note.—The U.S.P. includes a fluid extract, and a vinegar of Lobelia was formerly official therein.

VINCA.—Periwinkle.—The herb of Vinca major, *Linn.*, and of V. minor, *Linn.*

N.O.—Apocynaceæ.

Syn.—Pervenche.

Characters.—Stem ascending or prostrate; leaves ovate-acute or subcordate. Flowers large, purplish-blue.

Chemistry.—*Vincin*, tannin, etc.

Uses, etc.—As a mild astringent; given in infusion and fluid extract.

CHIRATA.—Chiretta.—The dried plant, Swertia Chirata, *Ham.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 183], collected when in flower.

N.O.—Gentianaceæ.

Syn.—Indian Gentian.

Habitat.—Northern India.

B.P. Characters.—Stem three feet or more (about a metre) in length, smooth, brown or purplish-brown in colour, slightly

winged and much branched above, rounded below, and containing a large, continuous, easily separable pith. Branches slender, elongated, decussate. Leaves opposite, ovate, glabrous, entire, usually with three or seven lateral veins. Flowers small, numerous, panicled. Fruits superior, bicarpellary, unilocular. No odour; taste extremely bitter.

Chemistry.—*Ophelic acid* ($C_{13}H_{20}O_{10}$) and *chiratin* ($C_{26}H_{46}O_{15}$). Ophelic acid is a bitter, viscid liquid, soluble in water; chiratin is a crystalline glucoside, breaking up under the action of dilute acids into ophelic acid and *chiratogenin*.

Uses, etc.—As a pure, bitter tonic.

B.P. Preparations.

Infusum Chiratæ	- - -	1 part in 20.
Liquor Chiratæ Concentratus	-	1 part in 2 of alcohol (20 per cent.)
Tinctura Chiratæ	- - -	1 part in 10 of alcohol (60 per cent.)

B.P.C. Preparation.—Infusum Chiratæ Concentratum.

Note.—This species of Chirata is variously known as SWERTIA, AGATHOTES, GENTIANA and OPHELIA CHIRATA. *Paharee Chiretta* [OPHELIA (SWERTIA) ANGUSTIFOLIA] is sometimes imported as true Chiretta; this adulterant may be distinguished by the absence of any distinct pith, and by the thickness of the wood, as seen when cut transversely. The lower portion of the stem is also quadrangular. Its infusion is of a paler colour. The root of *Munjeet* (RUBIA CORDIFOLIA) has been occasionally found in the centre of the bundles of Chiretta. Other adulterants or substitutions noted are OPHELIA ALATA and ANDROGRAPHIS PANICULATA. The latter plant is a native of India (*N.O.*—Acanthaceæ), and has valuable bitter tonic qualities, which are made use of in India.

CENTAURIUM.—Centaury.—The herb of Erythræa Centaurium, *Pers.*

N.O.—Gentianaceæ.

Habitat.—Europe.

Characters.—Stem one foot high, branching, divided above into a dichotomous panicle; bearing opposite, sessile, ovate-lanceolate, smooth and obtusely-pointed leaves; taste bitter; inodorous.

Chemistry.—*Erythro-centaurin* (colourless, crystalline, non-nitrogenous, reddened by sunlight), bitter principle, valeric acid, wax, etc.

Uses, etc.—Tonic, febrifuge. *Dose.*—30 to 60 grains in powder. Formerly official in the Edinburgh Pharmacopœia. An ingredient of the *Portland powder*.

Note.—*American Centaury* is the herb of SABBATIA ANGULARIS; it is said to have constituents and properties similar to the above. *Quinine flower* is derived from SABBATIA ELLIOTTII.

DULCAMARA.—Bittersweet.—The dried young branches of Solanum Dulcamara, *Linn.* Collected from plants which have shed their leaves.

N.O.—Solanaceæ.

Syn.—Woody nightshade.

Habitat.—Britain and Northern temperate zones generally.

Characters.—About a quarter of an inch or less thick, cylindrical, somewhat angular, longitudinally striate, more or less warty, usually

hollow in the centre, cut into short sections The thin bark is externally pale-greenish or light greenish brown, marked with alternate leaf scars, and internally green; the greenish or yellowish wood forms one or two concentric rings. Odour slight; taste bitter, afterwards sweet. The leaves of bittersweet are alternate, petiolate, and frequently auriculate. The inflorescence is cymose, the petals being deeply five-lobed and purple. The baccate fruits are oval, at first green, but acquiring as they ripen a bright red colour.

Chemistry.—*Solanine*, a crystalline alkaloid, insoluble or nearly so in water; *dulcamarin*, a glucoside decomposable into *dulcamaretin* and glucose.

Uses, etc.—Mild narcotic, etc. *Dose.*—60 to 120 grains. The B.P.C. contains an infusion. Formerly official in the U.S P. for the production of a fluid extract, also at one time included in the B.P.

Note.—Allied Species:—

Solanum nigrum (*common garden* or *black nightshade*) has ovate, stalked leaves, with coarse angular teeth; flowers white and baccate fruits black. This plant also contains solanine.

S. tuberosum (*common potato*). The green parts of this plant are said to contain solanine.

S. lycopersicum (Lycopersicum esculentum) (*tomato*). Solanine has been obtained from the herbaceous parts, and is probably present also in the seeds.

S. insidiosum (*jurubeba*) is largely used in South America in liver complaints, etc.

The *Jerusalem cherry* and *susumber berries* are obtained from species of solanum, and probably contain the alkaloid solanine.

PICHI.—Pichi.—The dried leafy twigs of Fabiana imbricata, *R. et P.*

N O.—Solanaceæ.

Syn.—Fabiana.

Habitat.—Chili.

Characters.—Small branches bearing twigs covered with scale-like imbricated leaves, the leaves being smooth, entire and of a bluish-green colour. Flowers solitary, terminal; corolla tubular, white or purple.

Chemistry.—Volatile oil, fat, resin, bitter fluorescent glucoside and an alkaloid *fabianine*.

Uses, etc.—Diuretic, etc., reputed of value in urinary diseases. *Dose* (of fluid extract).—½ to 1 fluid drachm.

MARRUBIUM.—Horehound.—The leaves and tops of Marrubium vulgare, *Linn.*

N.O.—Labiatæ.

Habitat.—Europe and Asia, cultivated.

Characters.—Leaves about one inch long, opposite, petiolate, roundish-ovate, obtuse, coarsely crenate, strongly rugose, downy above, white, hairy beneath; branches quadrangular, white, tomentose; flowers in dense, axillary, woolly whorls, with a stiffly ten-toothed calyx, a whitish, bi-labiate corolla, and four included stamens; aromatic and bitter.

Chemistry.—Volatile oil, *marrubin* (a bitter principle), with resin, tannic acid, and other principles.

Uses, etc.—Expectorant stimulant, tonic, etc. *Dose.*—15 to 30 grains in infusion. Official in the U.S.P.

The *B.P.C.* includes Syrupus Marrubii.

MENTHA PIPERITA.—Peppermint.—The leaves and tops of Mentha piperita, *Linn.*

N.O.—Labiatæ.

Habitat.—Europe, cultivated.

Characters.—Leaves about two inches long, petiolate, ovate-lanceolate, acute, sharply serrate, glandular, nearly smooth; branches quadrangular, often purplish; flowers in terminal, conical spikes having rounded summits, with a tubular, five-toothed, often purplish calyx, a purplish, four-lobed corolla, and four short stamens; odour aromatic; taste pungent and cooling.

Chemistry.—Volatile oil (0·25 to 1 per cent.), tannin, resin, gum, etc. (*see Oleum Menthæ Piperitæ*).

Uses, etc.—As source of the oil. Official in the U.S.P., where it enters into the composition of a spirit of peppermint.

MENTHA VIRIDIS.—Spearmint.—The leaves and tops of Mentha viridis (M. spicata), *Linn.*

N.O.—Labiatæ.

Syn.—Mentha sativa.

Habitat.—Europe, cultivated.

Characters.—Leaves about two inches long, greenish in colour, subsessile, lance-ovate, acute, serrate, glandular, nearly smooth; branches quadrangular, mostly light-green; flowers in terminal, interrupted, narrow, acute spikes, with a tubular, sharply five-toothed calyx, a light-purplish, four-lobed corolla, and four rather large stamens; aromatic and pungent.

Chemistry.—The chief constituent is the volatile oil (1 per cent.); *see Oleum Menthæ Viridis.*

Uses, etc.—As source of the oil. Official in the U.S.P., where it enters into the composition of a spirit of spearmint.

PULEGIUM.—Pennyroyal.—The herb of Mentha pulegium, *Linn.*

N.O.—Labiatæ.

Habitat.—Europe.

Characters.—Stem decumbent, branching, about six inches in height; leaves one-half to one inch in length, petiolate, ovate, blunt, crenate at the margin; dotted with oil glands; flowers in globose whorls; odour strong, pungent; taste highly aromatic.

Chemistry.—Volatile oil, of which the S.G. is from 0·930 to 0·960; it contains *pulegone*, a ketone.

Uses, etc.—Formerly much valued, and official in some countries; used as stimulant and emmenagogue. The oil (*oleum pulegii*) is still largely used, and a distilled water is also prepared.

HEDEOMA.—American Pennyroyal.—The leaves and tops of Hedeoma pulegioides, *Pers.*

N.O.—Labiatæ.

Habitat.—North America.

Characters.—Leaves opposite, short-petiolate, about half an inch long, oblong-ovate, obscurely serrate, glandular beneath; branches roundish-quadrangular, flowers in small axillary cymes (verticillasters), with a tubular-ovoid, two-lipped and five-toothed calyx, and a pale blue, spotted, two-lipped corolla, containing two sterile, and two fertile, exserted stamens; odour strong, mint-like; taste warm and pungent.

Chemistry.—Volatile oil (1 per cent.); its S.G. is 0·920 to 0·935, and it is readily soluble in alcohol; it contains *pulegone* ($C_{10}H_{16}O$), a ketone.

Uses, etc.—Carminative and stimulant. *Dose.*—15 to 60 grains in infusion. Both the herb and the oil are included in the U.S.P.

HYSSOPUS.—Hyssop.—The herb of Hyssopus officinalis, *Linn.*

N.O.—Labiatæ.

Habitat.—South Europe.

Characters.—Stem branched, wand-like; leaves sessile, one inch long linear-lanceolate, obtuse; flowers in small clusters, with five-toothed calyx, two-lipped purple corolla, and four exserted stamens; aromatic, pungent, bitterish.

Chemistry.—Volatile oil, of S.G. 0·925 to 0·940, containing oxygenated products.

Uses, etc.—Carminative, stimulant. *Dose.*—15 to 60 grains in infusion.

ORIGANUM.—Wild Marjoram.—The herb of Origanum vulgare, *Linn.*

N.O.—Labiatæ.

Habitat.—Asia, Europe, and North Africa.

Characters.—Stem branched above, often purplish, leaves opposite, petiolate, about one inch long, roundish-ovate, obtuse, nearly entire, pellucid-punctate, hairy beneath; flowers in corymbs, with reddish bracts, a five-toothed calyx, a somewhat two-lipped pale-purple corolla, and four exserted stamens; aromatic, pungent, and bitterish.

Chemistry.—Yields volatile oil (about 2 per cent.) of S.G. 0·87 to 0·91, containing but a trace of phenolic bodies.

Red Oil of Thyme is imported and sold as oil of origanum; it is often adulterated with oils of turpentine, spike lavender, and rosemary, coloured with alkanet root.

Uses, etc.—Carminative, stimulant, etc. *Dose.*—15 to 60 grains in infusion.

Note.—Sweet Marjoram (ORIGANUM MAJORANA) has a two-lipped calyx and a whitish corolla; it also contains a volatile oil, and has properties similar to the above. *Cretic o iganum oil* (Trieste Oil from O. HURTUM and Smyrna Oil from O. SMYRNÆUM) has S.G. above 0·910, and consists largely of phenols (chiefly carvacrol), the latter also containing a large amount of linalool.

MELISSA.—Balm.—The leaves and tops of Melissa officinalis, *Linn.*

N.O.—Labiatæ.

Habitat.—Europe, cultivated.

Characters.—Leaves abont two inches long, petiolate, ovate, obtuse, crenate, somewhat hairy, glandular; branches quadrangular; flowers in about four-flowered cymes (verticillasters), with a tubular, bell-shaped, five-toothed calyx, a whitish or purplish two-lipped corolla, and four stamens; fragrant, aromatic, and bitterish.

Chemistry.—Volatile oil ($\frac{1}{5}$ to $\frac{1}{4}$ per cent.), containing probably *citral* and *citronellal*, and having a S.G. of from 0·89 to 0·92. Commercial oil of balm is not a pure distillate but is probably oil of lemon distilled over balm (Oleum melissæ citratum).

Uses, etc.—Carminative, stimulant, etc. Formerly official in the U.S.P. *Dose.*—15 to 16 grains in infusion. The oil is used in perfumery.

MONARDA.—Horsemint.—The herb of Monarda punctata, *Linn.*

N.O.—Labiatæ.

Habitat.—United States of America.

Characters.—The stems are one to two feet high, herbaceous, obtusely angled, downy, whitish, branching; the leaves are about two inches long, oblong-lanceolate, remotely serrate, acute, narrowed at the base into a petiole, smooth above and glandular-dotted beneath; the flowers are of a yellow colour, spotted with red, brown or purple, and are arranged in verticillasters and surrounded by about eight leafy, sessile and entire bracts, which are pale yellow and purple in colour. Odour strong and aromatic. Taste warm, pungent, and bitterish.

Chemistry.—The chief constituent is the volatile oil (about 3 per cent.). This is of a yellowish, reddish, or brownish-red colour; lighter than water; readily soluble in alcohol; crystallising below 5°C.; and of a peculiar fragrant odour and pungent taste. It contains a terpene and oxygenated compounds, the most important of which is *thymol*.

Uses, etc.—Carminative, stimulant, etc. *Dose.*—15 to 60 grains in infusion. The oil is official in the B.P. as a source of thymol.

Note.—MENTHA SYLVESTRIS is known in England as horsemint, but the oil is not found in commerce.

SCUTELLARIA.—Scullcap.—The herb of Scutellaria lateriflora, *Linn.*

N.O.—Labiatæ.

Habitat.—North America.

Characters.—About twenty inches long, smooth; stem quadrangular, branched; leaves opposite, petiolate, about two inches long, ovate, lanceolate or ovate-oblong, serrate; flowers in axillary, one-sided racemes, with a pale-blue corolla, and a two-lipped calyx, closed when in fruit, the upper lip becoming helmet-shaped; odour slight; taste bitterish.

Chemistry.—Volatile oil, bitter glucoside, etc. *Scutellarin* is prepared by mixing a concentrated tincture with solution of alum; it is not a pure principle.

Uses, etc.—Antispasmodic, etc. *Dose.*—30 to 120 grains. Included in the U.S.P. for the production of a fluid extract.

Note.—Several other species of Scutellaria are collected and used in medicine.

EUPHORBIA.—Euphorbia.—The dried herb Euphorbia pilulifera, *Linn.*

N.O.—Euphorbiaceæ.

Habitat.—Queensland and South America, etc.

Characters.—Leaves opposite, shortly stalked, ovate to ovate-lanceolate or oblong, three-quarters to one and a half inches long, denticulate, oblique and narrow below or with a semi-cordate base. Flower heads minute, numerous, crowded in bead-like cymes, globular, borne on a short stalk in one axil only of each pair of opposite leaves. Stalks slender, cylindrical and hirsute. Fruits tricarpellary. Odour absent; taste bitter.

Chemistry.—Glucosides, resin and wax, with traces of tannin.

Uses, etc.—In asthma, etc. The B.P.C. includes a tincture (1 in 5 of 60 per cent. alcohol) and an extract is also prepared.

ACALYPHA.—Acalypha.—The herb of Acalypha indica, *Linn.*

N.O.—Euphorbiaceæ.

Habitat.—India

Characters.—Leaves ovate, cordate, hairy with crenate margins, about two inches long by one and a half inches broad; stems hairy; flowers small, green with involucre; fruit, a capsule.

Chemistry.—*Acalyphine* an alkaloid, tannin, resin and volatile oil.

Uses, etc.—Emetic, expectorant and laxative. Official in the Indian and Colonial Addendum for the production of a fluid extract and juice, the latter from the fresh herb.

CANNABIS INDICA.—Indian Hemp.—The dried flowering or fruiting tops of the female plant of Cannabis sativa, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 231], grown in India; from which the resin has not been removed.

N.O.—Urticaceæ.

Habitat.—India.

B.P. Characters.—In compressed, rough, dusky-green masses, consisting of the branched upper part of the stem, bearing leaves and pistillate flowers or fruits, matted together by a resinous secretion. The upper leaves of the plant are simple, alternate, 1-3-partite; the lower are opposite and digitate, and consist of five to seven linear lanceolate leaflets, with distantly serrate margins. The fruit is one-seeded and supported by an ovate-lanceolate bract. Both leaves and bracts bear external oleo-resin glands and one-celled curved hairs, the bases of which are enlarged and contain cystoliths.

Chemistry.—The activity of Cannabis Indica resides in the resinous matter and probably in that portion separated as *cannabinol* a red oil. Cannabinol however is not a pure substance, having been proved to be a mixture of at least two compounds. Cannabinol rapidly oxidizes on exposure and becomes less active therapeutically; to this alteration is attributed the deterioration which takes place in Indian hemp on keeping. Undetermined and probably unimportant alkaloidal matter is also present.

Uses, etc.—Sedative and hypnotic.

B.P. Preparations.

Extractum Cannabis Indicæ - alcoholic, yield 10 to 15 per cent.

Which is used in preparing

Tinctura Cannabis Indicæ - - 1 part in 20 of alcohol (90 per cent.)

Which is contained

Tinctura Chloroformi et Morphinæ Composita - - - - 1 part in 10.

Preparations other than B.P.—The U.S.P. includes a fluid extract; a compound of tannin with the non-resinous portion of the drug (Cannabinum tannas B.P.C.) is made, but its value is doubtful; the softer resinous portion of the drug is met with under the name of Cannabinonum B.P.C.

Note.—This diœcious plant is identical with the ordinary English hemp, Cannabis sativa, in botanical structure, the difference being that the latter does not secrete the peculiar resin which the Indian variety does. The ripe fruit of each is similar in physical characters. Of the native preparations of Indian hemp may be mentioned:

(1). *Churrus.*—This consists of the resinous exudation from the leaves, slender stems and branches. It is collected from the growing plants by natives clad in leathern dresses or naked, who run through the hemp fields; the soft resin adheres to the leather or skin, and is subsequently removed. This is the most intoxicating preparation derived from this plant, and is almost entirely employed for smoking. It comes from the Himalayas, Herat, and Yarkund.

(2). *Ganjah, gunjah, guaza.*—Consists of the dried plant bearing female flowers or fruits, and from which the resin has not been removed. It is the official form of the drug but is sold for smoking chiefly, and yields to alcohol 15 to 20 per cent. of resinous extract, composed of churrus and chlorophyll.

(3). *Bhang, bang, subjee,* or *sidhee* (Hindustanee); *hashish* (Arabic) is formed of the larger leaves and capsules, without the stalks. It may occur under the name of hashish in dark-coloured, soft, lozenge-shaped pieces, which seem to be composed of resin, sugar, and flavouring spices.

PARIETARIA.—Parietaria.—The herb of Parietaria officinalis, *Linn.*

N.O.—Urticaceæ.

Syn.—Wall pellitory.

Habitat.—Europe.

Characters.—Stem much branched, reddish, rough-hairy; leaves petiolate, alternate, short-hairy, elliptic, entire, acute; flowers polygamous, in axillary cymes with involucre of short bracts united at base. Inodorous, taste mucilaginous and slightly bitter.

Chemistry.—Nothing definite known.

Uses, etc.—In dropsy and externally in local inflammation. Given in decoction or expressed juice. The French make use of Sirop de Parietaire.

SABINÆ CACUMINA.—Savin Tops.—The fresh and dried tops of Juniperus Sabina, *Linn.* Collected in spring from plants cultivated in Britain.

N.O.—Coniferæ.

Habitat.—Britain.

Characters.—Twigs densely covered with minute imbricated appressed dark green (or when dried yellowish-green) leaves, with a large oval depressed central gland on their back. The older leaves are more spreading. Odour, when rubbed or bruised, strong and peculiar; taste acrid, bitter, and disagreeable.

Chemistry.—Volatile oil (4 to 5 per cent.), resin, tannin, etc.

Uses, etc.—Local and general irritant. *Dose.*—4 to 10 grains in powder. Formerly official for production of oil, tincture, and ointment, and still retained in the B.P.C. and the U.S.P., which latter includes a fluid extract.

Oleum Sabinæ, the volatile oil, formerly official, is colourless or pale yellow, of S.G. 0·910 to 0·930, and is soluble in an equal volume of alcohol. It contains terpenes; an alcohol called *sabinol*, $C_{10}H_{15}OH$, and its

acetate. Turpentine oil is a common adulterant of foreign distilled oils. In a good oil, sabinol should be present up to 40 per cent.

Note.—The tops of JUNIPERUS VIRGINIANA (red cedar) are sometimes substituted for savin, and are not readily distinguishable; the peduncle of the fruit (galbulus) is, however, erect, whilst that of J. Sabina is drooping; the odour and taste of the two drugs is also different.

THUJA.—Arbor Vitæ.—The fresh tops of Thuja occidentalis, *Linn.*

N.O.—Coniferæ.

Syn.—False White Cedar.

Habitat.—Canada; cultivated in Europe.

Characters.—Twigs flattish, two-edged, the scale-like leaves appressed and closely imbricate in four rows, rhombic-ovate, obtusely pointed with a roundish gland upon the back; balsamic, somewhat terebinthinate odour, and a pungently aromatic, camphoraceous, and bitter taste.

Chemistry.—Volatile oil, *pinipicrin* (a bitter principle), *thujin* (a crystalline colouring principle), wax, resin, and tannic acid are present.

Uses, etc.—Stimulant, diuretic, irritant. *Dose.*—15 to 60 grains in tincture or fluid extract. Also used externally in the form of an ointment.

Note.—CUPRESSUS THUJOIDES is also and more correctly known as white cedar.

8.—FRUITS.—FRUCTUS.

The true fruit consists of the fertilised gynæceum together with any appendages developed as secondary results of fertilisation and maturation. The term fruit, however, in its widest use is applied to the whole of the parts of the flower, however modified, persisting after fertilisation; according to this, the strawberry and fig are classed as fruits, whereas under the stricter definition they would be described as spurious fruits (*pseudocarps*). The outer covering of the fruit is known as the *pericarp*, and this is frequently represented by two layers—the *endocarp* and *exocarp*, with occasionally an intermediate *mesocarp*. The endocarp is not uncommonly hard and stony, forming a so-called *putamen*, while the exocarp may be either thin (*epicarp*) or fleshy (*sarcocarp*).

Fruits are—*simple*, *i.e.*, formed by the ripening of a single ovary; *aggregate*, from the ripening of a cluster of carpels of one flower crowded into a mass (raspberry); *accessory*, where the principle mass consists of the special development of some part of the flower not strictly belonging to the pistil (strawberry, dog-rose); *composite*, *i.e.*, formed by the union of a compact aggregation of the pistils of several flowers (*e.g.*, *sycon* of fig, *strobile* of hop, etc.). Simple fruits may be dry and *dehiscent*, *i.e.*, splitting into regular parts (*legume* of Leguminosæ, *cremocarp* of Umbelliferæ); dry and *indehiscent*, *i.e.*, not splitting when ripe (*achene* of Compositæ, *caryopsis* of Graminaceæ, etc.); fleshy and dehiscent (*berry*, *drupe*, *pepo*, *hesperidium*, etc.), also fleshy and indehiscent (edible chestnut).

The fruits which are made use of in medicine are frequently directed to be gathered unripe, since in their young state they contain a larger proportion of active constituents.

General Chemical Characters of Fruits.—The succulent fruits (prune, fig, raisin, bael, etc.) contain a notable quantity of sugar, mucilage, and vegetable acids, whilst many of the dry fruits owe their value in medicine to the presence of volatile oils and resins, this being especially true in the case of the Umbelliferæ. The fruits of the cereals (barley, wheat, etc.) are valuable only on account of the seeds which they contain, whilst in other cases (poppy, colocynth) the seeds are of little value in comparison with the pericarps.

ANISI STELLATI FRUCTUS.—Star Anise Fruit.—

The dried fruit of Illicium verum, *Hook, fil.* From plants cultivated in China.

N.O.—Magnoliaceæ.

Syn.—Semen Badiani.

Habitat.—China.

Characters.—Star anise fruit is usually composed of eight fully-developed carpels, diverging horizontally in a stellate manner from a short central, generally stalked, axis. Each carpel is boatshaped, more or less beaked, irregularly wrinkled, of a rust-brown colour, and commonly split on its upper margin so as to expose its solitary, flattish, smooth, shining, somewhat oblique, reddish-brown seed. Odour and taste of both pericarp and seed closely resemble those of anise fruit.

Chemistry.—The fruit contains from 3 to 4 per cent. of volatile oil, 3 per cent. of fat, 10 per cent. of resin, with a small quantity of tannin, mucilage, etc. The seeds contain about 2½ per cent. of volatile oil, 20 per cent. of fixed oil, and some resin.

Uses, etc.—Official as a source of oil of anise (*see Oleum Anisi*).

Note.—Adulteration of Star Anise Fruit.—Illicium religiosum (I. anisatum) (*N.O.*—Magnoliaceæ. *Habitat.*—Japan and China). The fruit of this species is one-third less in diameter than the official kind, and a few only of the carpels are generally developed to maturity. There is no taste of anise either in pericarp or seed; it contains a non-solidifying volatile oil which has a S.G. of 0·984, and a poisonous principle is also present. There are also several other species of Illicium which look like the official, but do not possess the same taste.

COCCULUS INDICUS.—Levant Nut.—

The dried fruit of Anamirta paniculata, *Colebr.*

N.O.—Menispermaceæ.

Syn.—Fishberry.

Habitat.—India.

Characters.—The fruit usually met with in commerce is not a berry, but a drupe, of a reniform shape, about the size of a small hazel nut; epicarp brown and membranous, covering a hard woody shell. When the fruit is transversely cut the seed is seen to be semilunar, generally occupying two-thirds of the interior, and is firmly attached to the placenta. No odour, but a very bitter taste resides in the seed.

Chemistry.—The seeds contain *picrotoxin, anamirtin (picrotin)*, and a large percentage of fat. The pericarp contains the basic bodies *menispermine, paramenispermine*, and *hypopicrotoxic acid.*

Uses, etc.—Externally as an insecticide. Official in the Indian Pharmacopœia, which includes an ointment of the drug.

B.P. Preparation.

Picrotoxinum.

Picrotoxinum P.B. (Picrotoxin) is a neutral principle obtained from the above fruit. It occurs in colourless and inodorous prismatic crystals, possessing a bitter taste. It melts at 378° F. (192·2° C.). It is soluble in 330 parts of cold or 35 of boiling *water*, and in 13 of cold or 3 of boiling *alcohol* (90 per cent.). It is soluble in 10 parts of *solution of potassium hydroxide*, and the resulting liquid, on boiling, immediately reduces *Fehling's solution.* Heated on platinum foil, the crystals melt, forming a yellowish liquid, which, on further heating, becomes charred, and is at length completely dissipated. It dissolves in *sulphuric acid* with a saffron-yellow colour. Its aqueous solution is not precipitated by *test-solution of mercuric chloride, solution of platinic chloride*, or *solution of tannic acid* (distinction from alkaloids).

Chemistry.—$C_{45}H_{50}O_{19}$, possibly a compound of two molecules of *Picrotoxinin* and *Picrotin*. Neither alkaloid nor glucoside, constitution unknown.

Uses, etc.—In epilepsy; for controlling night-sweats, etc. *Dose.*—$\frac{1}{100}$ to $\frac{1}{25}$ grain.

Note.—Picrotoxin has been used to add to beer, but such use is forbidden; increased bitterness and intoxicating effect result.

PAPAVERIS CAPSULÆ—Poppy capsules.

—The nearly ripe dried fruits of Papaver somniferum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 18].

N.O.—Papaveraceæ.

Syn.—Capita papaveris.

Habitat.—Cultivated in Britain, etc.

B.P. Characters.—Rounded, depressed, or ovoid capsules with a thin, dry, brittle pericarp. They are usually from two to three inches (five to seven and a half centimetres) in diameter, are suddenly contracted below into a neck, and are crowned above by the stellately arranged stigmas. The pericarp is pale yellowish-brown externally, and frequently marked with dark spots; from its inner surface a number of thin brittle parietal placentas project into the cavity. The seeds are numerous, small, reniform, reticulated and whitish. The fruits are inodorous; the pericarp has a bitter taste.

There are two well-marked varieties of this species:—

(*a*). Var. nigrum, which has a globose capsule, opening by pores under the stigma; seeds brownish-black; flowers violet or red of different tints, though sometimes white.

(*b*). Var. album, which has an ovate globose capsule, indehiscent, the pores under the stigma either obliterated or absent; seeds and petals white.

Chemistry.—The composition of the capsules depends upon the state in which they are collected: *morphine*, 0·28 per cent., *narcotine* and *rhœadine* having been found in ripe capsules, although a figure much lower than this has recently been given for morphine. Mucilage and a little waxy matter, and several organic acids (including *meconic acid*), are present.

Uses, etc.—Similar to opium, but feeble, and on account of their variability in alkaloid, uncertain in action. Formerly official for the preparation of decoction, extract and syrup. Used as an external soothing application in poultice or infusion form. The seeds of the poppy capsules are rejected when required for preparations, except in the case of Decoctum Papaveris, formerly official.

B.P.C. Preparations.—Decoctum Papaveris, Decoctum Anthemidis et Papaveris, Extractum Papaveris, Extractum Papaveris Liquidum, Syrupus Papaveris.

Note.—Maw seed (Poppy seeds) are the seeds of Papaver somniferum; they contain about 50 per cent. of a fixed oil (*see* Oleum Papaveris) official in the P.G. The seeds are demulcent, and being free from alkaloid, non-narcotic.

ANNOTTA.—**Annotta.**—The dried, prepared pulp of the fruit of Bixa orellana, *Linn.*

N.O.—Bixaceæ.

Syn.—Annatto.

Habitat.—Tropical America, East and West Indies.

Characters.—Plastic, or, when dry, hard and brittle, of a blood-red colour, becoming brown on exposure; odour peculiar; taste saline, disagreeable. Annatto softens in water, but is insoluble therein; it is soluble in alkalies, ether, alcohol and oils.

Note.—There are two varieties imported, viz., *Spanish Annotto*, coming from Brazil, which is hard and brittle, odourless, and usually in rolls. *French* or *Flag Annotto*, coming from Cayenne, which is bright yellow in colour, firm and soft to the touch, and usually in square cakes.

Chemistry.—Annatto contains a reddish crystalline, colouring matter, *bixin*, soluble in alkalies and reprecipitated by acids.

Uses, etc.—For colouring varnishes and lacquers; as a dye-stuff for cotton, silk and wood; for the production of cheese and butter colouring. Butter colouring is best obtained by dissolving one part of an alcoholic extract in ten parts of olive oil.

Note.—Annatto is frequently adulterated with, *e.g.*, ochre, sand, gypsum, and farinaceous substances. A fictitious annatto, with Venetian red as a basis, has been met with.

AURANTII CORTEX RECENS.—Fresh Bitter-Orange Peel.

—The fresh outer part of the pericarp of Citrus Aurantium, var. Bigaradia, *Hook, f.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 50].

N.O.—Rutaceæ.

Habitat.—Southern Europe.

B.P. Characters.—Externally deep orange-red or red in colour, and generally rough and glandular. On its inner surface there should only be a very small amount of the white spongy portion of the pericarp. Odour pleasant and aromatic, taste bitter.

Chemistry.—*See* Aurantii Cortex Siccatus.

Uses, etc.—For making the preparations named below.

B.P. Preparations.

†Tinctura Aurantii - 5 parts in 21, nearly, of alcohol (90 per cent.)

*Vinum " "

†*Used in the preparation of* Confectio Sulphuris, Syrupus Aromaticus, Syrupus Aurantii, Syrupus Cascaræ Aromaticus, Tinctura Quininæ, Trochiscus Sulphuris.

**Used in preparing* Vinum Ferri Citratis, Vinum Quininæ.

B.P.C. Preparations.—Elixir Aurantii Comp., Elixir Simplex, etc.

AURANTII CORTEX SICCATUS.—Dried Bitter-Orange Peel.

—The dried outer part of the pericarp of Citrus Aurantium var. Bigaradia, *Hook, f.*

N.O.—Rutaceæ.

Syn.—Aurantii Pericarpium.

Habitat.—Southern Europe.

B.P. Characters.—In thin strips. The outer surface is deep orange-red in colour, rough and glandular. On its inner surface there should only be a very small amount of the white spongy portion of the pericarp. Odour pleasant and aromatic, taste bitter.

Chemistry.—The rind contains volatile oil (*see* below), three glucosides—*hesperidin* ($C_{22}H_{26}O_{12}$), *isohesperidin*, *aurantiamarin* (the bitter principle), *aurantiamaric acid*, and resin, etc. The juice contains citric acid, but in less proportion than is found in lemons. The seeds contain a bitter principle.

B.P. Preparations.

Infusum Aurantii - - - - -	1 part in 20.
,, ,, Compositum - - -	1 ,, 40.
,, Gentianæ Compositum.	
Spiritus Armoraciæ Compositus.	
Tinctura Cinchonæ Composita.	
,, Gentianæ Composita.	

B.P.C. Preparations.—Infusum Aurantii Concentratum, Infusum Aurantii Compositum Concentratum, Infusum Gentianæ Compositum Concentratum.

Oleum Aurantii Corticis is the volatile oil extracted, by means other than distillation, from the fruits of the bitter and sweet orange (the bitter orange yields *Essence de Bigarade*, the sweet *Essence de Portugal*); it is a pale yellowish, strongly dextro-rotary liquid, of S.G. 0·848 to 0·856, and consists almost entirely of a terpene, *dextrolimonene* ($C_{10}H_{16}$), with traces of citral, citronellal, and the methyl ester of anthranilic acid. The oil rotates a ray of polarised light about 94°. It forms an ingredient of several elixirs included in the U.S.P., B.P.C., etc.

Note.—The unripe fruits (hesperidia) of the orange tree are used with the leaves in preparing *oil of petit grain* (*see* Aurantii Flores).

LIMONIS CORTEX.—Lemon Peel.

—The fresh outer part of the pericarp of the fruit of Citrus medica, *Linn.*, var. β Limonum, *Hook. f.* [*Bent. and Trim. Med. Pl.* vol. i. plate 54].

N.O.—Rutaceæ.

Syn.—Limonis Pericarpium.

Habitat.—Southern Europe (Messina, Reggio, Palermo).

B.P. Characters.—Pale yellow and more or less rough on the outer surface from the presence of glands containing volatile oil, which are embedded in the tissue beneath. On its inner surface there should be only a small amount of the white

spongy portion of the rind. Odour strong, characteristic, and fragrant; taste warm, aromatic, and bitter.

Chemistry.—*Hesperidin*, volatile oil (*see* Oleum Limonis), mucilage, protein, etc.

Uses, etc.—Chiefly as a flavouring agent; has stimulant properties.

B.P. Preparations.

Infusum Aurantii Compositum	1 part in 80.
,, Gentianæ Compositum	1 ,, 40.
*Oleum Limonis.	
Syrupus Limonis.	
Tinctura Limonis	1 part in 4, about, of alcohol (90 per cent.)

**Contained in*

Linimentum Potassii Iodidi cum Sapone, Spiritus Ammoniæ Aromaticus, Tinctura Guaiaci Ammoniata, Tinctura Valerianæ Ammoniata.

B.P.C. Preparations.—Tinctura Limonis fortior, Infusum Aurantii Compositum Concentratum.

Note.—Citrus medica yields the citron, a large fruit, the peel of which is used for preserving and yields an oil resembling Lemon Oil (commercial Oleum Cedratum is a mixture of *Citrus* Oils).

BERGAMIA.—Bergamot.—The fruit of Citrus Bergamia, *Risso et Poit.*

N.O.—Rutaceæ.

Habitat.—Southern Europe.

Characters.—Similar in colour to, but smaller than, the lemon; oval or roundish; rind smooth and thin; juice very acid.

Chemistry.—The most important constituent is the volatile oil. *Oil of bergamot* (*essence of bergamot, oleum bergamottæ*) is a fragrant-smelling, green-coloured oil, of S.G. 0·883 to 0·886; it is dextro-rotary, and most oils form a clear neutral solution with two volumes of 80 per cent. alcohol. It consists of *linalyl acetate* ($CH_3COOC_{10}H_{17}$), about 40 per cent. in oils of first quality, *limonene*, *dipentene*, and the stearoptene, *bergaptene* ($C_{12}H_8O_4$). The linalyl acetate, which is the valuable constituent, is broken up by age or by distillation of the oil into *linalool* and acetic acid. Like oil of lemon, this oil is much adulterated, orange and lemon oils being sometimes employed for this purpose.

Uses, etc.—As a source of the volatile oil, which is best obtained by cold extraction.

LIMETTÆ FRUCTUS.—Lime Fruit.—The fruit of Citrus medica, *Linn.*, var. acida, *Brandis.*

N.O.—Rutaceæ.

Habitat.—Cultivated in West Indies, etc.

Characters.—About half the size of the lemon; with a smoother and thinner rind; oval, rounded at the extremities, and of a pale-yellow or greenish-yellow colour. The rind possesses a fragrant odour, and a warm, aromatic, slightly bitter taste.

Chemistry.—The rind contains a volatile oil (*oil of limes*), and the fruit contains a juice valuable on account of the presence of citric acid (7 to 8 per cent.).

Uses, etc.—For the production of the juice and the essential oil. The former in addition to being a source of citric acid is much valued as a medicine in scurvy. The oil is used for flavouring purposes.

Oil of Limes is obtained both by expression and by distillation, the latter process resulting in a much less valuable oil. It has S.G. 0·870 to 0·882, it contains the terpene *limonene*, with a considerable quantity of *citral*.

Note.—Italian Limette Oil is derived from Citrus Limetta and is quite different in composition from the West Indian product. The main constituent is *Linalyl acetate* (26 per cent.), the oil generally resembling that of Bergamot. A considerable yellow deposit *limettin* forms on standing.

BELÆ FRUCTUS.—Bael Fruit.—The dried half-ripe fruit of Ægle Marmelos, *Correa*.

N.O.—Rutaceæ.

Syn.—Bengal Quince.

Habitat.—India.

Characters.—Fruit (hesperidium) roundish, about the size of a large orange, with a hard, woody, and nearly smooth rind; usually imported in dried, more or less twisted slices, or in fragments consisted of portions of the rind and adherent dried pulp and seeds. Rind about one-eighth of an inch thick, hard, and covered with a nearly smooth pale-brown or greyish, firmly adherent epicarp; the pulp firm and brittle, and of an orange-brown or cherry-red colour externally, but when broken it is seen to be nearly colourless internally. It has no odour, and the taste is simply mucilaginous and very slightly acid.

Chemistry.—Contains mucilage, pectic matter, vegetable acids, a volatile oil and a trace of tannin, the latter being insufficent, however, to produce a blackening with iron salts.

Uses, etc.—Formerly official for preparing a liquid extract, now included in the Indian and Colonial Addendum in the fresh, half-ripe condition; used in dysentery, etc., and said to have astringent properties. The ripe fruit is eminently edible, and is used in preparing a confection.

Note.—Substitutions.—*Mangosteen fruit* (Garcinia mangostana. *N.O.*—Guttiferæ. *Habitat.*—Malacca) is about the size and shape of an orange, having a short woody stalk, and possessing, at the opposite end to the stalk, a disk consisting of radiating stigmas, which are dark-coloured and wedge-shaped. Its pericarp, which easily peels off, is of a dark reddish-brown or blackish colour. Internally it is mucilaginous when moistened, and the pulp is separable from the pericarp. It contains tannin, resin, and a crystallisable principle, *mangostine*. *Elephant-apple* or *wood-apple* (Feronia elephantum. *N.O.*—Rutaceæ. *Habitat.*—India) is also sometimes substituted. It differs from the bael fruit in being one-celled, and is divided more or less into five compartments.

RHAMNI CATHARTICÆ FRUCTUS.—Buckthorn Fruit.—The ripe fruit of Rhamnus cathartica, *Linn.*

N.O.—Rhamnaceæ.

Habitat.—N. Africa, Central and S. Europe, Britain (Hertfordshire chiefly).

Characters (*of dry fruits*).—About the size of a pea, black and shining; at the apex are seen the remains of the style, at the base a portion of the persistent calyx. Each contains four hard, dark-brown, grooved, one seeded nuts or achænia. The cotyledons and albumen are of a horseshoe shape. Taste, bitter; odour, nauseous.

Chemistry. -The purgative principle is *Rhamno-emodin*, a glucosidal substance closely allied to that of Frangula bark. Three colouring matters have been isolated, *Rhamnocitrin*, *Rhamnolutin* and *Rhamnochrysin*.

Uses, etc.—For the preparation of the juice. Succus Rhamni (formerly official) is a liquid of a green colour when fresh, but is coloured red by acids (and hence by fermentation through keeping), yellow by alkalies; it has a bitter taste and a nauseous odour. It has a strongly purgative action, and is largely given to dogs. A medicinal syrup is prepared from it, and the pigment, *sap-green*, is obtained by evaporating it to dryness with an alkali.

UVÆ.—Raisins.—The ripe fruit of Vitis vinifera, *Linn.*, the Grape Vine, dried by the heat of the sun, or partly by the sun's heat, and partly by artificial heat. Imported from Spain.

N.O.—Ampelidaceæ.

Syn.—Uvæ passæ, Passulæ majores.

Habitat.—Spain.

Characters.—More or less shrivelled, compressed, smooth, free from sugary or saline incrustation; agreeably fragrant, and with a soft sweet pulp.

Chemistry.—The chief constituents are grape sugar, acid tartrate of potassium, gum, malic acid, with 5 to 6 per cent. tannic acid, (the last residing chiefly in the pericarp and integuments of seed). The seeds contain 15 per cent. of a tasteless fixed oil.

Uses, etc.—Chiefly as a flavouring agent, as in Tinctura Cardamomi Composita P.B. (1 in 10) for which they are to be used freed from seeds.

Note.—The varieties of the Grape vine are very numerous, the fruit being an example of the *nuculanium* or superior berry. *Raisins* are dried grapes, and the fruits not being articulated to the rachis, they are in some cases allowed to remain on the vine until dry, when they are known as *Muscatel Raisins*, or raisins of the sun, and these are considered to be the best. The *Lexias* are first dipped into a lye to which oil is added, and subsequently sun-dried. *Valencias* are cut away from the plants, dipped in a boiling dilute lye and afterwards dried. Some raisins of inferior quality are dried artifically. The saccharine substance on the exterior of raisins is the juice which has exuded and candied. *Sultana Raisins* are seedless and come from Smyrna. From the absence of seeds they would be useful in preparing the B.P. tinctures, but they are excluded. The *Spanish* or *Valencia Grapes* are alone official, and hence are chiefly used in the pharmacies, the seeds being removed before use. The currants (*Uvæ passæ minores*) of the grocers are really Corinthian Raisins, obtained from a very small variety of grape called the Black Corinth, which is grown chiefly in the Isles of the Grecian Archipelago.

ANACARDIUM.—Cashew-nut.—The fruit of Anacardium occidentale, *Linn.* (Cassuvium pomiferum).

N.O.—Anacardiaceæ.

Habitat.—Tropical America.

Characters.—Reniform, about one inch long, three-quarters of an inch broad, and two-fifths of an inch thick; grey-brown, finely punctate, having two shells with a black juice between them, and enclosing an oily kernel.

Chemistry.—*Cardol* (oily, acrid, poisonous), *anacardic* acid, tannin, gum, etc.; the seeds contain a bland fixed oil.

Uses, etc.—The juice as vesicant, and as an indelible writing fluid; the seeds as food.

Note.—The *Oriental Cashew-nut*, obtained from SEMECARPUS ANACARDIUM (*Habitat.*—India), is ovate, heart-shaped, and has similar properties to the above.

RHUS GLABRA.—Sumach.—The fruit of Rhus glabra, *Linn.*, collected in early autumn.

N.O.—Anacardiaceæ.

Habitat.—North America.

Characters.—Sub-globular, about one-eighth of an inch in diameter, drupaceous, crimson, densely hairy, containing a roundish-oblong, smooth putamen with a single seed. It is inodorous, and its taste acidulous and astringent.

Chemistry.—Tannic acid (1 to 2½ per cent.), a little gallic acid, malic acid, fixed and volatile oil.

Uses, etc.—As astringent and refrigerant. Official in the U.S.P. for the production of a fluid extract. The bark, which contains tannic acid (8 to 15 per cent.), is used by tanners.

CASSIÆ PULPA.—Cassia Pulp.—The pulp obtained from the pods of Cassia Fistula, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 87].

N.O.—Leguminosæ.

Habitat.—East and West Indies.

B.P. Characters.—The pods are from a foot and a half to two feet (thirty-five to fifty centimetres) long, and from three-quarters to one inch (eighteen to twenty-five millimetres) in diameter. They are nearly cylindrical in shape, shortly stalked, blackish-brown, very hard, indehiscent, the sutures being marked by two smooth longitudinal bands. They are divided internally by thin transverse partitions into numerous cells, each containing a smooth, flattish-oval, reddish-brown seed, surrounded by pulp. The pulp, which alone is official, is viscid and nearly black, with a faint odour and sweet taste.

Chemistry.—Composed of sugar, pectin, gum, etc. No definite purgative principle has as yet been isolated.

Uses, etc.—Laxative; usually given with other medicines.
Dose.—60 to 120 grains.

B.P. Preparation.

Confectio Sennæ - - - -	1 part in 8, nearly.

Note.—Substitutions, Etc.—Cassia grandis (brasiliana), *Horse Cassia* has legumes which are much longer and larger, one and a half inch in diameter, the valves having very prominent sutures and transverse branching veins; odour strong and disagreeable. A lighter coloured purging Cassia, which is sometimes met with, is probably obtained from Cassia moschata.

St. John's Bread, Siliqua dulcis, the fruit of Ceratonia siliqua (*N.O.*—Leguminosæ. *Habitat.*—Southern Europe), has similar constituents to the above, and also has demulcent and laxative properties.

Cassie flowers are derived from Acacia farneesiana (*N.O.*—Leguminosæ) and are much used in perfumery.

TAMARINDUS.—Tamarinds.—The fruit of Tamarindus Indica, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 92], freed from the brittle outer part of the pericarp, and preserved with sugar.

N.O.—Leguminosæ.

Habitat.—India and Tropical Africa, cultivated in the West Indies, etc.

B.P. Characters.—A reddish-brown, moist, sugary mass, enclosing strong, branched fibres, and brown, shining seeds, each enclosed in a tough, membranous coat. Taste agreeable, refreshing, subacid. A piece of bright iron left in contact with the pulp for an hour does not exhibit any deposit of copper.

Chemistry of the Pulp.—Water, citric, tartaric, and malic acids; acid tartrate of potassium; gum, pectin, and sugar. Copper is only an occasional accidental impurity. The seeds contain much tannic acid.

Uses etc.—Refrigerant; laxative. *Dose.*—½ to 2 ounces.

B.P. Preparation.

Confectio Sennæ - - - - - - 9 parts in 75.

Note.—Those from the West Indies, known as "brown or red" tamarinds, are preserved with moist sugar or in syrup. The East Indian or "black" tamarinds are imported in a dry condition, and with portions of the husk. The seeds are used as a food in times of scarcity by the natives of Central India.

PRUNUM.—Prune.—The dried ripe fruits of Prunus domestica, *Linn. var.* Juliana, *D.C.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 96]. Imported from the South of France.

N.O.—Rosaceæ.

Habitat.—S. W. Asia, cultivated.

B.P. Characters.—Somewhat ovoid or oblong, about one inch and a quarter long, black, shrivelled; pulp brownish, without marked odour, but with a sweet and somewhat mucilaginous, acid taste.

Chemistry.—In the sarcocarp, sugar 12 to 25 per cent., pectin, malic acid, and salts; the seeds contain fixed oil, emulsin, and amygdalin.

Uses, etc.—As nutritive and laxative.

B.P. Preparations.

Confectio Sennæ - - - - - - 1 in 12½.

ROSÆ CANINÆ FRUCTUS.—Fruit of the Dog-Rose; Hips.—The ripe fruit of Rosa canina, *Linn.*, and other indigenous allied species.

N.O.—Rosaceæ.

Syn.—Fructus Cynosbati.

Habitat.—Britain.

Characters.—Three-quarters of an inch or more in length, ovoid or somewhat oval, smooth, shining, scarlet or red; inodorous; taste pleasant, sweetish, acidulous.

Chemistry.—Citric and malic and a trace of tannic acids, gum, sugar, and salts.

Uses, etc.—Refrigerant, slight astringent; formerly official and largely used as an excipient in pill masses; as Confectio Rosæ Caninæ B.P.C.

Note.—The fruit of the dog-rose is a cynarrhodon and consists of an ovoid thalamus or disc (with calyx tube), become dilated and succulent by growth, and containing numerous dry achenes; the latter are rejected in preparing the confection.

RUBUS IDÆUS.—**Raspberry.**—The fruit of Rubus idæus, *Linn.*

N.O.—Rosaceæ.

Habitat.—Europe, cultivated.

Characters.—Deprived of the conical receptacle, and therefore, hollow at the base; hemispherical, red, finely hairy, composed of from twenty to thirty coalesced small drupes, each one crowned with the withered style; juice red; of an agreeable odour and pleasant, acidulous taste.

Chemistry.—Sugar, citric and malic acids, nitrogenous matter, etc., and a trace of volatile oil.

Uses, etc.—Refrigerant, laxative, etc.; formerly included in the U.S.P. for the production of a syrup.

Note.—The U.S.P. also allowed of the use of the closely allied, light red fruit of Rubus strigosus (wild red raspberry) and the purplish-black fruit of Rubus occidentalis (wild black raspberry) in place of the above.

MYROBOLANUS.—**Myrobolans.**—The dried immature fruit of Terminalia chebula, *Retz.*, etc.

N.O.—Combretaceæ.

Syn.—Black Myrobolans.

Habitat.—India.

Characters.—One-half to one inch long, oblong or ovoid, obtusely five or six-angled and ribbed, yellowish-brown, the endocarp pale-brown and resinous dotted, containing a white seed.

Chemistry.—Tannin (about 40 per cent.), *myrobolanin* (a resin), *chebulinic acid.* In the seeds a fixed oil.

Uses, etc.—Astringent, official in the Indian and Colonial Addendum as a substitute for Galls; much used for tanning purposes.

PIMENTA.—**Pimento.**—The dried full-grown unripe fruit of Pimenta officinalis, *Lindl.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 111].

N.O.—Myrtaceæ.

Syns.—Jamaica Pepper; Allspice.

Habitat.—West Indies.

B.P. Characters.—Dark reddish-brown, nearly globular, two-celled fruits, varying usually from one-fifth to one-third of an inch (five to eight millimetres) in diameter. The pericarp is

rough externally, brittle, and crowned by the remains of the four-toothed calyx in the form of a raised ring, surrounding the remains of the style. Each cell contains a single brownish-black reniform seed. Odour and taste warm and aromatic, characteristic, somewhat resembling those of cloves.

Chemistry.—Volatile oil (3 to 4 per cent., *see* Oleum Pimentæ), green fixed oil, resin, and much tannic acid and starch. Ash not more than 4 to 5 per cent.

Uses, etc.—As stimulant and aromatic. *Dose.*—10 to 30 grs. in powder. Also largely employed for flavouring purposes.

B.P. Preparations.

Aqua Pimentæ - - - - - 8 ozs. in gallon.
Oleum Pimentæ.

Note.—Allspice is picked in an unripe condition and is dried by the sun or in kilns, if allowed to ripen it becomes almost destitute of aroma. It is a spice, inasmuch as it is chiefly aromatic; a pepper being pungent. It is cultivated in Jamaica, in regular walks, called "pimento walks."

GRANATI FRUCTUS CORTEX.—Pomegranate Peel.—The dried peel of the fruit of Punica Granatum, *Linn.*

N.O.—Granataceæ (Lythrariaceæ).

Habitat.—Europe.

Characters.—In irregular, more or less concave fragments, some of which have the toothed tubular calyx still enclosing the stamens and style. It is one-twentieth to one-tenth of an inch thick, easily breaking with a short, corky fracture. Externally it is rough, of a yellowish-brown or reddish colour. Internally, it is more or less brown or yellow, and honeycombed by depressions left by the seeds. It has no perceptible odour, but a strongly astringent taste.

Chemistry.—Tannin (24 to 30 per cent.), sugar, gum, and ash (6 per cent.)

Uses, etc.—As astringent, now little used. *Dose.*—15 to 30 grains in powder or decoction. Formerly included in the U.S.P.

COLOCYNTHIDIS PULPA.—Colocynth Pulp.—The dried pulp of the fruit of Citrullus Colocynthis, *Schrad.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 114], freed from seeds.

N.O.—Cucurbitaceæ.

Syn.—Bitter Apple.

Habitat.—Smyrna, Trieste, France, and Spain.

B.P. Characters and Tests.—The fruit is usually imported peeled, in more or less broken balls about two inches (five centimetres) or less in diameter. The Pulp, which alone is official, is light, spongy, whitish, and odourless, but intensely bitter. It should not yield the characteristic reactions with the tests for starch, and only traces of fixed oil should be removed from it by *ether.* It yields, when dried at 212° F.

(100° C.) and incinerated, at least 9 per cent. of ash (indicating absence of seeds).

Note.—The above tests are intended to detect added starch and, what is a much more likely adulterant, unremoved seeds. Nearly three-fourths of the peeled fruit consists of seeds which may be detected, not only by means of the fat (15 to 20 per cent.) which they contain, but also by the microscope, which reveals the albuminous granules of their cotyledons. Petroleum ether forms a better solvent than ether for extracting any fixed oil since the latter also dissolves colocynthin. The most carefully prepared pulp usually contains a small percentage of seeds. The pulp has been shown to yield 10·1 to 12·5 per cent. of ash, the seeds 2 to 5 per cent. The *Pulvis colocynthidis* of commerce contains a large proportion of seeds.

Chemistry.—A glucoside, *colocynthin* (1 per cent.), which is the active principle. It is soluble in water, more so in alcohol, and insoluble in ether. There are also present—extractive matter, fixed oil, resin (insoluble in ether), gum, lignin, etc. Starch and tannic acid are absent.

Uses, etc.—As hydragogue cathartic and aperient. *Dose.*—2 to 8 grains.

B.P. Preparations.

Extractum Colocynthidis Compositum	1 part in $4\frac{1}{2}$, about.
*Pilula Colocynthidis Composita	1 part in 6, about.

**Used in preparing*

Pilula Colocynthidis et Hyoscyami	2 parts in 3.

B.P.C. Preparations.—Tinctura Colocynthidis, etc.

Note.—Colocynth also comes from Mogadore, but this kind is usually larger than the official kind, of a darker colour externally, and is not peeled; its seeds also have a darker testa.

LUFFA.—Gourd Towel.—The fruit deprived of its epidermis and parenchymatous tissue, split and dried, of Luffa egyptiaca, *Mill.*, etc.

N.O.—Cucurbitaceæ.

Habitat.—India and Egypt.

Characters.—A durable skeleton of interwoven, woody fibres.

Uses, etc.—In place of sponge.

ECBALLII FRUCTUS—Squirting Cucumber fruit.

—The fruit, very nearly ripe, of Ecballium Elaterium, *A. Richard.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 115]; from plants cultivated in Britain.

N.O.—Cucurbitaceæ.

Habitat.—Europe; cultivated in Britain.

Characters.—Ovoid-oblong, nodding, about one and a half inches long, with numerous short, fleshy prickles terminating in white, elongated points. Attached by a long, scabrous peduncle, fleshy and green when young, yellowish when mature; three-celled, with numerous oblong seeds lodged in a bitter, succulent pulp. At the time of ripening, the fruit becomes disengaged from the stalk, and the seeds and juice are forcibly expelled at the point of articulation.

Uses, etc.—For the preparation of Elaterium.

Elaterium B.P. (Extractum Elaterii) is described as a sediment from the juice of the Squirting Cucumber Fruit. It is obtained by pressing out the juice, allowing it to deposit, filtering out the deposit and drying it on porous tiles. Thus obtained, it occurs in light, friable, flat or slightly curved opaque cakes, about one-tenth of an inch thick; pale-green, greyish-green, or yellowish-grey, according to age; fracture finely granular, odour faint, tea-like; taste bitter and acrid. Does not effervesce with acids; boiled with water, and the cooled mixture treated with iodine, affords little or no blue colour; yields half its weight to boiling rectified spirit. Treated by the method described in the Pharmacopœia it should yield 25 per cent., or not less than 20 per cent., of Elaterin. It contains, in addition to Elaterin, chlorophyll, starch, lignin, ash, etc.; and bodies named, respectively, *ecballin*, *prophetin*, *hydro-elaterin*, and *elateride* have also been described. Elaterium is used as a powerful hydragogue cathartic in doses of $\frac{1}{16}$ to $\frac{1}{2}$ grain.

B.P. Preparation (of Elaterium).—Elaterinum.

Elaterinum ($C_{20}H_{28}O_5$), the active principle of Elaterium, is obtained by exhausting with chloroform, adding ether to the chloroformic solution, collecting the precipitate, washing it with ether, and purifying by recrystallizing from chloroform. It is a neutral substance, occuring in small, colourless crystals, insoluble in water, soluble in rectified spirit. It has a bitter taste, and, when heated with access of air, melts and then burns, leaving no residue. With carbolic acid it yields a solution which, on the addition of sulphuric acid, acquires a crimson colour, rapidly changing to scarlet. It is not precipitated from solution by tannic acid, nor by the salts of mercury or of platinum.

Uses, etc.—Similar to Elaterium; one of the most powerful hydragogue cathartics known. *Dose.*—$\frac{1}{40}$ to $\frac{1}{10}$ grain.

B.P. Preparation (of Elaterinum).

Pulvis Elaterini Compositus - - - -	1 in 40.

CONII FRUCTUS.—Conium Fruit.—

The dried, full-grown unripe fruits of Conium maculatum, *Linn.*

N.O.—Umbelliferæ.

Syn.—Hemlock fruit.

Habitat.—Britain.

B.P. Characters and Test.—Broadly ovoid in shape, greenish-grey in colour; about one-eighth of an inch (three millimetres) long, and nearly as broad, somewhat laterally compressed, and crowned by the depressed stylopod. In the drug as met with in commerce the mericarps are usually separated: each

is glabrous and possesses five irregular, more or less crenate, primary ridges; the endosperm is deeply grooved on the commissural surface, and in the transverse section of the mericarp no vittæ are visible. No marked odour or taste, but when rubbed with *solution of potassium hydroxide* a strong disagreeable odour is produced resembling that of mice.

Note.—The crenate ridges and absence of vittæ are important characters for distinguishing this fruit from others of the same natural order.

Chemistry.—*Coniine* $C_8H_{17}N$ ($\frac{1}{2}$ to $1\frac{1}{4}$ per cent. or more), *methyl-coniine* $C_9H_{19}N$, *conhydrine* $C_8H_{17}NO$, *pseudoconhydrine*, *ethyl piperidine*, a little volatile oil, and fixed oil and ash (5 to 6 per cent.). (*See* also Conii Folia). The U.S.P. fixes a standard of not less than 0·5 per cent. Coniine and describes fruits of more than two years old as unfit for use.

Uses, etc.—As anodyne, antispasmodic and narcotic.

B.P. Preparation.

Tinctura Conii - 1 part in 5 of alcohol (70 per cent.).

B.P.C. Preparation.—Extractum Conii Liquidum (1 per cent. of alkaloidal hydrochlorides).

Coniine (*Conine, Conia*) $C_8H_{17}N$ or $C_5H_{10}(C_3H_7)N$, is a colourless, volatile, oily liquid, having a S.G. 0·862 at 0° C. and boiling point 165° to 170° C. It has a disagreeable, penetrating, mouse-like odour, and biting taste. It is slightly soluble in water (1 in 180), freely in alcohol and ether (1 in 6), and, being powerfully alkaline, neutralizes the strongest acids perfectly, forming uncrystallizable or very deliquescent salts. Its chloride, however, is not deliquescent. On exposure to air it evolves ammonia, becomes brown, and thickens to a semi-solid, owing to rapid absorption of oxygen. It dissolves silver chloride. Sulphuric acid causes it to assume a purplish-red, turning to olive-green; nitric acid, a blood red; and gaseous hydrochloric acid, an indigo blue colour. It may be obtained by passing superheated steam into the powdered fruits, previously macerated in solution of sodium carbonate. The distillate which contains the alkaloid is neutralized with hydrochloric acid or may be rendered alkaline and treated with ether, which dissolves out the coniine. Coniine has been synthetically prepared by the reducing action of sodium on allyl-pyridine $C_5H_4(C_3H_5)N$, and is hence regarded as having the constitution of an *α-normal propyl-piperidine* (*see* appendix—"Alkaloids.")

Note.—It has been shown (Farr and Wright) that while commercial samples of fruit yield but an average of 0·67 per cent. alkaloidal hydrochlorides, carefully collected English fruits yielded an average of 2·13 per cent. This extreme difference is probably owing to the difficulty of collecting fruits of exactly the right period of development, ripe fruits showing a marked decrease in alkaloidal strength.

CARUI FRUCTUS.—Caraway Fruit.—

The dried fruit of Carum Carvi, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 121].

N.O.—Umbelliferæ.

Habitat.—West Asia and West Africa, cultivated in Germany, Holland, Russia, England, etc.

B.P. Characters and Tests.—Mericarps usually separate; each from about one-sixth to one-fourth of an inch (four to six millimetres) long, and about one-twenty-fifth of an inch (one millimetre) broad; brown in colour with paler primary ridges,

slightly curved, tapering towards each end and glabrous. The transverse section of each mericarp exhibits six vittæ. Odour aromatic; taste aromatic and agreeable. When incinerated the fruit should not yield more than 8 per cent. of ash.

Chemistry.—Volatile oil (*see Oleum Carui*) $3\frac{1}{2}$ to $6\frac{1}{2}$ per cent., ash 5 to 7 per cent.

Uses, etc.—Stimulant, carminative, etc. The exhausted seed after the distillation of the oil contains a high percentage of protein and fat, and is used as a cattle food.

B.P. Preparations.

Aqua Carui	1 part in 10.
Confectio Piperis	3 parts in 20.
*Oleum Carui.	
Pulvis Opii Composita	1 part in $2\frac{1}{2}$.
Tinctura Cardamomi Composita	1 „ 80.
„ Sennæ Composita	1 „ 40.

**Used in the preparation of*

Pilula Aloes Barbadensis.

Note.—Black Caraway, *see* Nigella.

CORIANDRI FRUCTUS.—Coriander Fruit.

—The dried ripe fruit of Coriandrum sativum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 133].

N.O.—Umbelliferæ.

Habitat.—South Europe, Asia; cultivated extensively.

B.P. Characters.—Nearly globular, about one-fifth of an inch (five millimetres) in diameter, uniform brownish-yellow in colour, and glabrous. The two mericarps usually remain closely united, and are crowned by the calyx teeth and stylopod. Primary ridges waxy and inconspicuous; secondary ridges straight and more prominent. The transverse section exhibits two vittæ on the commissural surface of each mericarp. Odour aromatic, especially when bruised; taste agreeable.

Chemistry.—Volatile oil (*see Oleum Coriandri*) 0·3 to 1·0 per cent., fat, mucilage, ash (5 to 7 per cent.), etc.

Uses, etc.—Stimulant, aromatic, stomachic. *Dose.*—20 to 60 grains.

B.P. Preparations.

Confectio Sennæ	1 part in 25.
*Oleum Coriandri.	
Syrupus Rhei	1 part in 15, about.
Tinctura Rhei Composita	1 „ 80.
„ Sennæ Composita	1 „ 40.

**Used in preparing*

Syrupus Sennæ.

Note.—Indian Coriander is ovoid in shape and forms a distinct commercial variety.

ANISI FRUCTUS.—Anise Fruit.

—The dried ripe fruit of Pimpinella Anisum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 122].

N.O.—Umbelliferæ.

Habitat.—Southern and Central Europe.

B.P. Characters.—The fruit is ovoid in form, somewhat laterally compressed, and rough from the presence of short, bristly hairs; greyish-brown in colour; about one-fifth of an inch (five millimetres) long and one-twelfth of an inch (two millimetres) broad. The mericarps usually remain united and attached to the pedicel. The primary ridges are pale, slender, and entire. Each mericarp exhibits, in transverse section, numerous vittæ. Odour agreeably aromatic, taste aromatic and sweet.

Note.—There are three varieties in commerce. (1) Alicante (South-east of Spain); (2) German: (3) Russian. They are placed in the order of merit. The last is much smaller than the others, being about the size of conium fruits; it has persistent pedicels, and the mericarps remain united, are covered with minute hairs, and have a fancied resemblance to small mice. Russian aniseed is mainly used for the preparation of the oil. Conium fruits (*q.v.*) are devoid of vittæ, and any admixture with anise can be detected by the mouse-like odour produced on moistening the crushed fruit with caustic potash solution.

Chemistry.—Volatile oil (2 to 3 per cent.), fixed oil, sugar, mucilage, ash (7 per cent.).

Uses, etc.—Stimulant, carminative, etc.

B.P. Preparations.

Aqua Anisi - - - - - - 1 part in 10.
Oleum Anisi, *which is used in preparing*
Spiritus Anisi - - - - - 1 part in 10.
Tinctura Camphoræ Composita.
Tinctura Opii Ammoniata.

FŒNICULI FRUCTUS.—Fennel Fruit.—

The dried ripe fruit of Fœniculum capillaceum, *Gilib.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 123], collected from cultivated plants.

N.O.—Umbelliferæ.

Habitat.—Southern Europe; cultivated extensively.

B.P. Characters.—From one-fifth to about two-fifths of an inch (five to ten millimetres) long, and about one-tenth of an inch (three millimetres) in diameter, oblong, more or less curved, capped by a conspicuous stylopod and two styles, glabrous, greenish-brown or pale yellowish-brown in colour; odour aromatic; taste aromatic, sweet and agreeable. The fruit is readily separated into its two mericarps, each of which has five prominent primary ridges and exhibits in transverse section six large vittæ.

Note.—Varieties of Fennel.—The most esteemed variety is Saxon or German fennel fruit, about one-quarter of an inch long, and of a greenish-brownish tint. The

Roman variety (French sweet fennel) is still longer and of a distinctly greenish tint. Indian, Russian and French bitter (wild) are inferior sorts, deficient in essential oil and dark in colour. Fœniculum dulce is only a variety of Fœniculum capillaceum. This fruit is the largest of the official cremocarps.

Chemistry.—Volatile oil (2 to 6 per cent.), fixed oil, sugar, protein, mucilage, ash (7 to 9 per cent.).

Uses, etc.—Stimulant, aromatic, carminative.

B.P. Preparations.

Aqua Fœniculi - - - - - 1 part in 10.
Pulvis Glycyrrhizæ Compositus.

B.P.C. Preparations.—Elixir Rhei, Infusum Sennæ Compositum, Syrupus Mannæ Compositus.

Oleum Fœniculi, the volatile oil, is included in the Pharmacopœia of the U.S. and in many of those of the European Continent. It is a colourless, pale-yellowish liquid, having a mild, spicy taste, and the characteristic aromatic odour of fennel. The S.G. of the oil is 0·960 to 0·980 or higher, and it usually solidifies when reduced in temperature to 5° C. It is soluble in alcohol and glacial acetic acid. In constitution it is similar to the volatile oil of anise (*q.v.*), but it contains less *anethol* (60 per cent.), and in addition *fenchone* ($C_{10}H_{16}O$), *pinene, phellandrene and dipentene.*

ANETHI FRUCTUS.—Dill Fruit.

—The dried ripe fruit of Peucedanum graveolens, *Benth. and Hook. f.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 132].

N.O.—Umbelliferæ.

Habitat.—Southern Europe; cultivated.

B.P. Characters.—The two mericarps of which the fruit is composed are usually separate and freed from the pedicel; each of them is broadly oval, about one-sixth of an inch (four millimetres) long and from one-twelfth to one-eighth of an inch (two to three millimetres) broad. Very strongly compressed dorsally. They are brown in colour; the dorsal ridges are inconspicuous, but the lateral are prolonged into paler brown wings. Odour and taste agreeably aromatic. Each mericarp exhibits, in transverse section, six vittæ.

Chemistry.—Volatile oil 3 per cent. (*see* Oleum Anethi), fixed oil, protein, mucilage, ash, etc.

Uses, etc.—Stimulant, aromatic, carminative; used in flatulency of infants.

B.P. Preparations.

Aqua Anethi - - - - - - 1 part in 10.
Oleum Anethi.

Note.—Indian dill is derived from a plant P. Sowa, regarded by some as a distinct species, it is paler, thinner and less winged than the official variety, its mericarps are usually united and its essential oil possesses distinct characters.

ANGELICA.—Angelica Fruit.—The fruit of Angelica Archangelica, *Linn.*

N.O.—Umbelliferæ.

Syn.—Garden Angelica.

Habitat.—Central and North Europe.

Characters.—Oblong, from one-sixth to one-fourth of an inch in length, light yellow or yellowish-green in colour, usually separated into mericarps, each having five wing-like ridges and an indefinite number of vittæ; odour and taste pleasantly aromatic.

Chemistry.—Volatile oil (containing *phellandrene* and other terpenes with oxygenated constituents, etc.), *angelic acid*, valeric acid, sugar, bitter principle, starch, etc.

Uses, etc.—As aromatic tonic. *Dose.*—30 to 60 grains.

PETROSELINI FRUCTUS.—Parsley Fruit.—The fruit of Petroselinum sativum *Hoffm.* (Apium Petroselinum).

N.O.—Umbelliferæ.

Habitat.—Southern Europe.

Characters.—About one-twelfth of an inch long, ovate, laterally compressed, greenish or brownish-grey, smooth, mostly divided into the two mericarps, and these with five filiform, pale-coloured ribs, flat on the face, and containing six vittæ; odour and taste aromatic.

Chemistry.—Volatile oil 2 to 6 per cent., S.G. 1·050 to 1·100, consisting of terpenes and *apiol*. There are also present fixed oil, resin, *apiin* (probably a glucoside), mucilage, and ash. Apiol $C_{12}H_{14}O_4$ is an oily, non-nitrogenous allyl compound, insoluble in water, unattacked by alkalies, soluble in alcohol, and crystallizable when pure.

Uses, etc.—Carminative, stimulant, diuretic. *Dose.*—10 to 30 grains in powder, etc.

Note.—The activity of the fruit is probably due to the volatile oil, and the value of this also probably depends upon the amount of apiol it contains. The name apiol has also been applied to an oleo-resin prepared from the plant.

AJOWAN.—Ajowan Fruit.—The fruit of Carum (Ptychotis) Ajowan, *Benth. et Hook.*

N.O.—Umbelliferæ.

Habitat.—India, Persia, Egypt.

Characters.—About one-twelfth of an inch long, ovate, laterally compressed, grey-brown, rough and finely warty, usually divided into the two mericarps, and these with five thin ribs, flat on the face, and with six vittæ; odour aromatic, thyme-like; taste pungent, aromatic.

Chemistry.—Volatile oil (3 to 4 per cent.), containing *cymene* and *thymol* (50 per cent.). The fruits also contain a considerable quantity of fat and protein.

Uses, etc.—One of the officially-named sources of thymol (*see* Thymol).

CUMINUM.—Cumin Fruit.—The fruit of Cuminum Cyminum, *Linn.*

N.O.—Umbelliferæ.

Habitat.—North-eastern Africa; cultivated.

Characters.—Oblong, five or six millimetres long, narrowed at both ends, laterally compressed, brown, rough-hairy; mericarps united, or separate, with five filiform, yellowish ribs, four broader ones of a brown colour, and six vittæ; odour and taste peculiar, somewhat like caraway.

Chemistry.—Volatile oil (upwards of 1 per cent.), fixed oil, resin, mucilage, ash, etc.

Uses, etc.—Stimulant, anti-spasmodic, carminative. *Dose.*—10 to 30 grains in powder. The source of Oil of Cumin.

Oleum Cymini, the volatile oil, is limpid, pale-yellow in colour, of S.G. 0·890 to 0·930. It consists of *cymene* ($C_{10}H_{14}$), *cuminol* (*cumic aldehyde* $C_6H_4.C_3H_7.COH$), and a terpene ($C_{10}H_{16}$). Cymene, which is methyl-propyl-benzene, may be prepared by the reduction of camphor.

PHELLANDRIUM.—Horse-bane.—The fruit of Œnanthe Phellandrium, *Lam.*

N.O.—Umbelliferæ.

Syn.—Five-leaved water-hemlock.

Habitat.—Europe and Northern Asia.

Characters.—Oblong or oblong-ovate, one-sixth to one-fifth of an inch long, nearly terete, brown or blackish-brown, smooth, each mericarp with five broad and obtuse ribs, four narrow grooves and six vittæ; odour caraway-like, but unpleasant; taste aromatic, bitter, and somewhat acrid.

Chemistry.—Volatile oil, fixed oil, resin, etc.

Uses, etc.—Diaphoretic, stimulant, diuretic, etc. *Dose.*—15 to 60 grains in powder or infusion.

CAROTA.—Carrot-fruit.—The fruit of Daucus Carota, *Linn.*

N.O.—Umbelliferæ.

Habitat.—Northern Asia and Europe; cultivated.

Characters.—About one-sixth of an inch long, oval, dorsally compressed, grey-brown, each mericarp with six thin vittæ, and nine ribs, of which five are hairy and four beset with long spiny bristles; odour slightly aromatic; taste pungent.

Chemistry.—Volatile oil, S.G. 0 870 to 0·930, consisting mainly of *pinene* with undetermined bodies.

APIUM.—Celery Fruit.—The dried fruit of Apium graveolens, *Linn.*

N.O.—Umbelliferæ.

Syn.—Celery Seed.

Habitat.—Levant, South Europe; cultivated.

Characters.—About one-twenty-fifth of an inch long, roundish, ovate, laterally compressed, brown, smooth, mostly divided into the two mericarps, and these with five filiform ribs; flat on the face, and containing twelve vittæ; aromatic.

Chemistry.—Volatile oil, S.G. 0·88, mainly *d-limonene* with some oxygenated constituents; fixed oil, and mucilage.

Uses, etc.—Carminative, stimulant; used for flavouring.

RANDIA.—Randia.—The dried ripe fruit of Randia dumetorum, *Linn.*

N.O.—Rubiaceæ.

Habitat.—India.

Characters.—About the size of a crab-apple, round, two-celled, many-seeded, and crowned with the rim of the calyx. It has a peculiar, sweetish, sickly smell, and a taste at first sweet, but afterwards nauseous.

Chemistry.—*Randia-saponin, randic acid* (similar to quillaic acid), tannin, fat, etc.

Uses, etc.—Emetic, antispasmodic. Used by natives of India as the former; has been recommended in tincture as the latter.

EMBELIA.—The dried fruit of Embelia Ribes, *Burmann.*

N.O.—Myrcinaceæ.

Habitat.—India.

Characters.—Small reddish-black drupes, wrinkled, resembling black pepper, but rather smaller.

Chemistry.—*Embelic acid* $C_9N_{14}O_2$, crystalline, insoluble in water, soluble in alcohol; tannin, volatile oil, etc.

Uses, etc.—As anthelmintic; official in the Indian and Colonial Addendum. Ammonium embelate has also been used as an anthelmintic.

DIOSPYRUS.—Persimmon.—The unripe fruit of Diospyros embryopteris, *Pers.*

N.O.—Ebenaceæ.

Habitat.—Common in forests throughout India.

Characters.—About the size of a small apple, of a yellowish rusty colour, covered with a rubiginous farina; eight-seeded, abounding with a viscid, very astringent juice.

Chemistry.—Tannic acid, malic acid, sugar and pectin.

Uses, etc.—As astringent, tonic, and febrifuge. Included in the Indian Pharmacopœia. *Dose.*—15 to 60 grains in infusion or tincture.

Note.—D. virginiana is a North American species with similar properties.

CAPSICI FRUCTUS.—Capsicum.—The dried ripe fruit of Capsicum minimum, *Roxb.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 188].

N.O.—Solanaceæ.

Habitat.—Cultivated in India, Zanzibar, etc.

B.P. Characters and Test.—Dull orange-red, oblong-conical, obtuse, two-celled fruits, from about one-half to three-quarters of an inch (twelve to twenty millimetres) in length and a quarter of an inch (six millimetres) in diameter; sometimes attached to a five-toothed inferior calyx, and a long, straight, slender peduncle. The pericarp is somewhat shrivelled, glabrous, translucent, and leathery, and contains from ten to twenty small flat seeds, either loose or attached to a thin reddish

dissepiment. Odour characteristic; taste intensely pungent. On incineration Capsicum should not yield more than 6 per cent. of ash.

Chemistry.—*Capsaicin*—$C_9H_{14}O_2$, 0·02 per cent. (colourless, crystalline, volatile, highly acrid, soluble in ether, alcohol, benzol, glacial acetic acid and fats, etc.), red-colouring matter, fats, resin, and ash 4 to 5 per cent. A volatile alkaloid resembling coniine is also present. *Capsicin* is a name applied to the oleo-resin. *Capsacutin* (intensely pungent, containing nitrogen) has also been described.

Uses, etc.—In medicine as stimulant, etc., internally; as rubefacient, externally. Its chief application is, however, for the production of the powder (*Cayenne pepper*), and as an ingredient of sauces, etc.

B.P. Preparations.

*Tinctura Capsici - 1 part in 20 of 70 per cent. alcohol.
Unguentum ,, - 1 ,, 4 nearly.

**Used in the preparation of*
Tinctura Chloroformi et Morphinæ Composita.

B.P.C. Preparations.—Extractum Capsici liquidum, Linimentum Capsici Compositum, Oleo-resina Capsici (Capsicin, an alcoholic extract, the similar preparation of the U.S.P. is an acetone extract), Tinctura Capsici fortior (Turnbull's tincture), Unguentum oleo-resin. Capsici, Linimentum Capsici, Linimentum Capsici Comp., Emplastrum Capsici, Gossypium Capsici, etc.

Note.—Varieties of Capsicum.—The "chillies" of commerce vary much both in size and pungency. The fruit of Capsicum annuum, which is cultivated in Europe, is two inches or more long, pear-shaped or conical, with a dark orange, leathery, shining and shrivelled pericarp, having at the base the remains of the calyx and often a portion of the stalk. Inodorous, but possessing a very pungent taste. Tasteless capsicums are grown and find use in preparations made by bird fanciers.

CHENOPODIUM.—American Wormseed.—The fruit of Chenopodium ambrosioides *var.* anthelminticum, *Gray.*

N.O.—Chenopodiaceæ.

Habitat.—Indigenous to West Indies, Central and South America.

Characters.—Nearly one-twelfth of an inch in diameter, depressed, globular, glandular; dull-greenish or brownish, the integuments friable, containing a lenticular, obtusely-wedged, glossy-black seed. It has a peculiar, somewhat terebinthinate odour, and a bitterish, pungent taste.

Chemistry.—A reliable analysis of the plant is needed. It contains a volatile oil.

Uses, etc.—As vermifuge; formerly official in the U.S.P. for the preparation, by distillation, of Oleum Chenopodii. Employed under the name of *Herba Santa Maria* as anthelmintic, and in pectoral complaints. *Dose.*—15 to 45 grains in powder or infusion.

Note.—Jerusalem Oak is the product of C. botrys, and is said to have similar properties to the above.

PHYTOLACCA.—Poke Berry.—The fruit of Phytolacca decandra, *Linn.*; collected in August.

Habitat.—North America.

Characters.—A depressed-globular, dark-purple, compound berry, about one-third of an inch in diameter, composed of ten carpels, each containing one lenticular, black seed; juice, purplish-red; inodorous; sweet, slightly acrid.

Chemistry.—*See Phytolaccæ Radix.*

Uses, etc.—Alterative, laxative, emetic. *Dose.*—5 to 15 grains in infusion. Formerly official in the U.S.P. for the production of a fluid extract. The root alone is now recognised.

CUBEBÆ FRUCTUS.—Cubebs.

The dried full-grown unripe fruits of Piper Cubeba, *Linn. fil.* [*Kew Bulletin*, December, 1887, p. 3].

N.O.—Piperaceæ.

Syn.—Tailed Pepper.

Habitat.—East Indies.

B.P. Characters and Test.—Nearly globular, sometimes depressed at the base, about one-sixth of an inch (four millimetres) in diameter, greyish-brown or nearly black in colour. The pericarp is reticulately wrinkled, thin, brittle, and abruptly prolonged at the base into a slender rounded stalk which is about one and a half times the length of the globular portion, within which is a single seed attached by the base. A transverse section of the pericarp exhibits two layers of sclerenchymatous cells, one near the outer, the other near the inner surface, those of the latter being radially elongated. Odour strong, aromatic, and characteristic; taste warm, aromatic, and somewhat bitter. The crushed fruit imparts a crimson colour to *sulphuric acid*.

Chemistry.—Volatile oil 5 to 15 per cent. (*see* Oleum Cubebæ), *cubebin* $C_{20}H_{20}O_6$, m.p. 132° C. (inodorous, crystalline, bitter), resin (3 per cent.), *cubebic acid* (2 per cent.), fat, wax, starch, ash (5 to 6 per cent.). Cubebic acid gives a crimson, cubebin a cherry-red colour with sulphuric acid.

Uses, etc.—Cubebs have a stimulant and carminative action, owing to the volatile oil which they contain; but the chief value of the drug is due to the cubebic acid, which has diuretic properties. *Dose.*—30 to 120 grains.

B.P. Preparations.

Oleum Cubebæ.

Tinctura Cubebæ - 1 part in 5 of alcohol (90 per cent.)

B.P.C. Preparations.—Extractum Cubebæ liquidum, Oleo-resin. Cubebæ (an ethereal extract from which precipitated wax and cubebin is rejected, the corresponding U.S.P. preparation is an alcoholic extract).

Note.—Varieties, Adulterations and Substitutions of Cubebs.—The fruit as met with in commerce always contains some proportion of the nearly inodorous rachis. An excess of this must be regarded as an adulterant.

The following adulterations and substitutions have from time to time been noted :—

Cubeba (Piper) Clusii (*African cubebs, Ashantee pepper*) has a fruit one-third smaller than the official cubebs, tastes like black pepper, and contains not cubebin but piperine.

Piper Crassipes has a fruit similar to, if not identical with, the above; like the latter, it gives a reddish-brown, not a crimson colour, with concentrated sulphuric acid.

Daphnidium Cubeba (*N.O.*—Lauraceæ) has a cubeb-like berry which, however, possesses a distinctive and lemon-like odour, and readily splits into its two oily cotyledons. In powder it gives a yellowish-brown (not crimson) colour with concentrated sulphuric acid. Holmes refers this plant to Litsea (Tetranthera) citrata, the source of the so-called "citronelle fruits."

Cubebs with a mace-like odour are sometimes met with in commerce; these are probably derived from Piper (Cubeba) lewong, a native of Java, and are similar in appearance to, but somewhat larger than, the fruits of Piper Clusii.

For article on Cubebs and their adulterations, with plates, *see P. J.* [3] xxv. p. 314, *et seq.*

PIPER NIGRUM.—Black Pepper.

—The dried unripe fruit of Piper nigrum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 245].

N.O.—Piperaceæ.

Habitat.—East Indies (cultivated).

B.P. Characters.—Almost black, nearly globular, inferior, one-celled fruits, usually about one-fifth of an inch (five millimetres) in diameter. The pericarp is deeply and reticulately wrinkled, and contains a single seed that completely fills the cavity. Odour aromatic; taste pungent.

Chemistry.—Volatile oil (1 to 2 per cent., containing *phellandrene* and other terpenes, non-pungent but representing the odour of the fruit); *piperic acid*, an acrid, soft resin; *piperine* (4·5 to 8 per cent.); fat, starch and ash (at most 6 per cent.). Piperine ($C_{17}H_{19}NO_3$) is a feebly basic principle found in black pepper and other peppers. It occurs, when pure, in colourless, transparent, sublimable crystals, insoluble in water, soluble in alcohol, ether, etc., and is resolved by alkalies into *piperic acid* and *piperidine*. Piperidine ($C_5H_{11}N$) is soluble in water and alcohol, and forms crystalline salts with acids. The pungent taste and medicinal activity of pepper appear to be due to the piperine.

Note.—Piperine has been prepared artificially from piperidine and piperic acid. Piperidine is of interest chemically as being *hexa-hydro-pyridine*. (*See* note on Coniine).

Uses, etc.—Carminative, stimulant, and mild febrifuge. *Dose.*—5 to 20 grains in powder.

B.P. Preparations.

Confectio Piperis - - - - -	1 part in 10.
Pulvis Opii Compositus - - - -	1 „ 7½.

Preparations other than B.P.—*Heliotropin* (*Piperonal*), used in perfumery, may be prepared from piperic acid or piperine, it has the constitution of the methylene ether of protocatechuic aldehyde, viz. $C_6H_3.OOCH_2.CHO$.

The *B.P.C.* and *U.S.P.* include Oleo-resin. Piperis (an acetone extract), the former also Linimentum Capsici Comp., and Confectio Rutæ.

Note.—Adulteration of Pepper.—This is practised chiefly on the powder, and may be usually detected by means of the microscope. *Poivrette* or *pepperette*, a reputed adulterant, is said to consist of ground olive stones. The starch of pepper has distinctive characters.

PIPER ALBUM.—White Pepper.—The ripe fruit of Piper Nigrum, more or less deprived of the pericarp.

N.O.—Piperaceæ.

Habitat.—East Indies.

Characters.—Globular, smooth, with ten or twelve veins from base to apex, whitish, containing an albuminous seed, having small starch grains; odour and taste pepper-like, but less pungent than black pepper.

Chemistry.—Similar to that of black pepper, but containing less of the active principles; more starch but less ash than the black variety.

Uses, etc.—As black pepper.

PIPER LONGUM.—Long Pepper.—The dried unripe spike (catkin), of Piper officinarum, *D.C.* or P. longum, *Linn.*

N.O.—Piperaceæ.

Habitat.—Java, Bengal, etc., the best coming from Batavia and Singapore.

Characters.—The spike of immature, closely packed, coalesced berries forms a long, nearly cylindrical body, one to one and a half inch in length, tapering slightly towards its upper end. A transverse section of the spike exhibits eight or ten separate fruits, arranged radially with narrower ends pointed towards the axis. The white colour is due to lime, its natural colour being brown.

Chemistry, uses, etc.—Analogous to those of black pepper; an ingredient in Tinctura Cinnamomi Comp. B.P.C.

LAURI FRUCTUS.—Bay Berries.—The fruit of Laurus nobilis, *Linn.*

N.O.—Lauraceæ.

Syn.—Baccæ Lauri.

Habitat.—Indigenous to the Levant; naturalized in the countries bordering the Mediterranean.

Characters.—The so-called bay berries are oval drupes, about one-third of an inch long, oval, having a brownish-black, friable, somewhat wrinkled thin pericarp, enveloping a solitary loose oval seed, which mainly consists of two fatty cotyledons, of a brownish colour, having an aromatic, oily, and bitter taste.

Chemistry.—Volatile oil (consisting of hydrocarbons, cineol, eugenol, etc.), fixed oil, resin, etc.

Uses, etc.—Chiefly for the production of the expressed oil (*see below*), which has some use as an external stimulant; the berries are a constituent of Confectio Rutæ B.P.C.

Oleum Lauri Expressum (Oleum Laurinum) is obtained in South Europe by steeping the bruised fruit in hot water, and subsequently pressing. The process yields 20 to 25 per cent. of a green fat having a lard-like granular appearance and an aromatic odour and taste. It melts at about 33° C., and is soluble in ether, and in hot alcohol, and does not yield its colouring matter to water. It consists of volatile oil with *trilaurin*, the triglyceride of lauric acid, etc. Lard and similar fats coloured with turmeric and indigo have been used as adulterants and substitutes.

Note.—The fruit of Laurus Benzoin (the Canadian *spice bush*) contains much fat and a fragrant volatile oil, and that of Laurus persea (Persea gratissima) the South American *alligator pear*, contains a butyraceous fat, and is eaten like butter.

MEZEREI FRUCTUS.—Mezereon Fruit.—The fruit of Daphne Mezereum, *Linn.*

N.O.—Thymelaceæ.

Syn.—Fructus coccognidii.

Habitat.—Southern Europe.

Characters.—Berry-like, in the fresh state red, globular, ovate or oval, about one-fifth of an inch thick; after drying, brown or black, wrinkled; containing a glossy black seed; inodorous, but having a strongly acrid, burning taste.

Chemistry.—Gum, vegetable acids, protein compounds, drying oil (30 per cent.), and *coccognin*, which unlike daphnin, is not a glucoside, and sublimes unchanged.

Uses, etc.—The fruits possess a narcotico-acrid action.

CANNABIS FRUCTUS.—Hempseed.—The ripe fruit of Cannabis sativa, *Linn.*

N.O.—Urticaceæ.

Habitat.—Asia; widely cultivated.

Characters.—Each so-called seed is a roundish-ovate achene about one-sixth of an inch long; the pericarp is greenish-grey or brown, and encloses a single oily seed.

Chemistry.—Fixed oil of the "drying class," 33 to 35 per cent.; albuminoids, 16 per cent., etc.

Uses, etc.—As cattle food, and for the production of the fixed oil.

Note.—It is only the female hemp plants obtained from India which contain narcotic constituents (*see* Cannabis Indica).

LUPULUS.—Hops.—The dried strobiles of Humulus Lupulus, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 230]; collected from cultivated plants.

N.O.—Urticaceæ.

Syn.—Humulus.

Habitat.—Britain; cultivated.

B.P. Characters.—The strobiles are about one inch and a quarter (three centimetres) long, oblong-ovoid or rounded in form, and consist of a number of imbricated greenish-yellow membranous stipules and bracts, attached to a hairy zig-zag axis. Each of the bracts enfolds at its base a small rounded achene which, like the base of the bract, is sprinkled with yellow glands. The odour is aromatic and characteristic, the taste bitter, aromatic, and somewhat astringent.

Chemistry.—Volatile oil, bitter principle (*lupuramic acid*), resin, tannin, trimethylamine, wax (*myricyl palmitate*), ash (6 to 7 per cent.). The tannin (*humulo-tannic acid*) is resident in the scales, which themselves contain but traces of the remaining constituents of the strobile, these being present in the glands (Lupulinum).

Uses, etc.—Internally stomachic, sedative; used also in the form of fomentation or poultice; much used for brewing purposes.

Volatile oil of hops has S.G. from 0·855 to 0·880. It consists largely of a sesquiterpene *humulene* with *linalool, geraniol* and other oxygenated constituents yet undetermined. The oil was formerly said to yield valerianic acid on keeping owing to the oxidation of a body called *valerol* which it was supposed to contain.

B.P. Preparations.

Infusum Lupuli	-	1 part in 20.
Tinctura Lupuli	-	1 „ 5 of alcohol (60 per cent.)

B.P.C. Preparations.—Extractum Lupuli, Infusum Lupuli Concentratum.

Note.—Hops are picked in September, dried by artificial heat in kilns, and packed in large, long bags or pockets. Those which have been subjected to the treatment of "sulphuring" are not to be used in pharmacy. This process is conducted with a view of improving the colour and odour of hops, since sulphuric acid is found to retard the production of the valerianic odour, and to both preserve and improve the colour of the hops.

FICUS.—Figs.

—The dried fleshy receptacles of Ficus Carica, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 228].

N.O.—Moraceæ.

Habitat.—Southern Europe.

B.P. Characters.—The fig consists of the enlarged hollow succulent receptacle, bearing very numerous achenes on its inner surface. It is compressed, irregular in form, soft, tough, more or less translucent, brownish or yellowish, and covered with a saccharine efflorescence. Taste, luscious; odour, fruity and pleasant.

Chemistry.—Glucose, fat, protein, gum, calcium malate and other salts.

Uses, etc.—Nutritive, laxative, demulcent.

B.P. Preparation.

Confectio Sennæ.

B.P.C. Preparations.—Syrupus Ficorum, Syrupus Ficorum Comp., and Syrupus Ficorum Aromat.

Note.—The fruit of the fig is a *syconus*, and consists of a concave fleshy thalamus in which are embedded numerous achenes. Botanically it is not a true fruit. *Smyrna* figs are more esteemed than *Greek* figs, the latter being tougher and containing less pulp. *Natural* figs are packed loosely and retain a globular shape, *pulled* figs are rendered pliant by kneading and are compressed in packing.

MORUS.—Mulberry.

—The ripe fruit of Morus nigra, *Linn.*

N.O.—Moraceæ.

Habitat.—Asia; cultivated.

Characters.—The fruit is a shortly-stalked, spurious berry (*etærio* or *sorosis*), oblong, an inch in length, and, when ripe, of an intense purple colour; each consists of a mass of agglomerated drupes, enclosing a hard,

lenticular nucule, covering a pendulous seed, with curved embryo and fleshy albumen.

Chemistry.—Glucose, protein, pectin, colouring matter, tartaric and malic acids, ash, etc.

Uses, etc.—Refrigerant, laxative, etc. The juice prepared from it was formerly included in the British Pharmacopœia.

VANILLA.—Vanilla.— The prepared unripe fruit of Vanilla planifolia, *Andrews.*

N.O.—Orchidaceæ.

Habitat.—Indigenous to Eastern Mexico; cultivated widely in the tropics.

Characters.—From six to ten inches long, linear, narrowed and bent or hooked at the base, rather oblique at the apex; wrinkled, somewhat warty; dark-brown, glossy, leathery, one-celled, and containing a blackish-brown pulp, with numerous minute seeds, and more or less acicular crystals; odour and taste peculiar and fragrant.

Mexican Vanilla is the best; other varieties are known as Bourbon, Seychelles, Mauritius, South American, and Tahiti Vanillas.

Chemistry.—Fixed oil, soft resin, bitter extractive, sugar, starch, and benzoic acid. The odorous principle, which is frequently to be seen whitening the surface of the pods, is a crystalline body with a hot, biting taste, having the constitution of methyl-protocatechuic aldehyde, and is known as *vanillin* $C_6H_3(COH)(OCH_3)(OH)$. It is freely soluble in alcohol, ether, and chloroform, difficultly in cold water. It is found in traces in numerous other drugs, including benzoin and asafetida, and was originally prepared synthetically from *coniferin* ($C_{16}H_{22}O_8+2H_2O$), a glucoside found in the sap of conifers, by the action thereon of acids and oxidising agents; it has also been prepared from guaiacol, and by other means, but its chief source is eugenol.

Uses, etc.—In medicine obsolete; the B.P.C. and U.S.P. include a tincture; largely used for flavouring. For this purpose, preparations of Vanilla are preferred to the artificially prepared vanillin.

Note.—Preparation of Vanillin from Guaiacol.—Guaiacol is acted upon by chloroform and caustic alkalies according to the following reaction:—

$$C_6H_4\begin{cases}OH\\OCH_3\end{cases}+CHCl_3+3KOH-C_6H_3\begin{cases}COH\\OCH_3\\OH\end{cases}+3KCl+2H_2O.$$

The constitution of Vanillin should be compared with that of *heliotropine*, which is the methylene ether of protocatechuic aldehyde (*see* under Piper Nigrum).

CARDAMOMI SEMINA.—Cardamom Seeds.—The dried ripe seeds of Elettaria Cardamomum, *Maton* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 267]. The seeds should be kept in their pericarps and separated when required for use.

N.O.—Zingiberaceæ (Scitamineæ).

Habitat.—Southern India; largely cultivated in Ceylon.

B.P. Characters and Test.—The fruits usually vary from two-fifths to four-fifths of an inch (one to two centimetres) in length; they are ovoid or oblong in shape, bluntly triangular in

section, and shortly beaked at the apex, pale buff in colour, and longitudinally striated. The seeds are dark reddish-brown in colour, about one-eighth of an inch (three millimetres) in length, and the same in breadth and thickness, irregularly angular, transversely wrinkled, and enclosed in a thin, colourless, membranous aril. Odour and taste agreeably warm and aromatic. Incinerated they should not yield more than 4 per cent. of ash.

Chemistry.—Fixed oil (10·4 per cent.), volatile oil (4·6 per cent.), an acrid resin, ash (about 4 per cent. containing manganese). The S.G. of the volatile oil is 0·940, and it contains terpenes (*limonene*, etc.), with *terpinyl acetate* and other esters, the nature of which is at present incompletely known.

Uses, etc.—Carminative, stimulant, usually given with other medicines. *Dose of seeds.*—5 to 20 grains.

B.P. Preparations.

Extractum Colocynthidis Compositum	1 part in 27, nearly
Pulvis Cinnamomi Compositus	1 part in 3.
,, Cretæ Aromaticus	1 ,, 44.
*Tinctura Cardamomi Composita	1 ,, 80 of alcohol (60 per cent).
,, Gentianæ ,,	1 part in 80.
,, Rhei ,,	1 ,, 80.

**Used in the preparation of*

Decoctum Aloes Compositum.
Mistura Sennæ Composita.

B.P.C. Preparations.—Tinctura Cardamomi, Tinctura Carminativa, Pulvis Aromaticus Comp., etc.

Varieties of Cardamoms :—

Ceylon Wild Cardamoms, from Elettaria Cardamomum *var* major, are one and a half inches long, acutely triangular, with flat, longitudinally striated sides, and attenuated apices ; colour darker than the official.

Round Cardamoms, from Amomum cardamomum and A. globosum (from Java, Siam, China, etc.), are of the size of a cherry, globular or ovoid, with three convex sides.

Bengal Cardamoms from Amomum subulatum, are one inch long, oblong or oval, with nine wings near the apex.

Nepal Cardamoms are similar to the above, with a long beak-like calyx ; origin unknown.

Winged Java Cardamoms, from Amomum maximum, are globose, one inch long, obtusely triangular, with three or four short membranous wings on each side.

SABAL.—Saw Palmetto.—The partially-dried ripe fruit of Serenoa serrulata, *Hook, f.*

N.O.—Palmaceæ.

Habitat.—United States of America.

Characters.—Irregularly spherical to oblong-ovoid, deep red-brown, slightly wrinkled, half to one inch long, and about half an inch in diameter; containing a hard brown seed.

Chemistry.—Volatile oil, fixed oil, glucose and alkaloidal matter.

Uses, etc.—Has been recommended as urinary sedative and diuretic, official in the U.S.P. *Dose.*—As fluid extract, 1 to 2 fluid drachms.

HORDEUM DECORTICATUM.—Pearl Barley.—The dried seed of Hordeum distichon, *Linn.*, divested of its integuments. From plants cultivated in Britain.

N.O.—Graminaceæ.

Habitat.—Britain.

Characters.—White, rounded, with a trace of the longitudinal furrow, in which are the remains of the yellowish-brown integuments. Taste and odour farinaceous, like the cereal grains generally.

Note.—The fruit (Caryopsis) of the cereals, and of the grasses generally, is frequently spoken of as a seed, on account of its having the pericarp completely and inseparably attached to the seed. *Scotch, Hulled* or *Pot Barley* consists of the grain with the husk partly removed by a mill. *Patent Barley* is the ground decorticated grain. *Pearl Barley* is the grain, minus its integuments, rounded and polished, and is the official kind.

Chemistry.—Water 14·0 per cent.; nitrogenous matter (including gluten, etc.), 12 to 15 per cent.; fat, 1 per cent.; carbohydrates, 75·0 per cent.; fibre, 0·6 per cent.; ash, 0·8 per cent.

Uses, etc.—In medicine, as a nutrient and demulcent.

Maltum, Byne, is the seed of Hordeum distichon, caused to enter the incipient stage of germination by artificial means, and dried. The process of *malting* barley, which begins by *steeping* and ends in drying, is conducted with the view of developing the largest quantity possible of the ferment or enzyme *diastase*, the formation of which is the first step in the process of fermentation. Diastase, like the ferment found in saliva, has the property of converting starch suspended in water into a mixture of dextrin and *maltose*. Germinated barley contains about 6·2 per cent. of diastase, and this body is capable of converting about two thousand times its weight of starch. Diastase is a white, tasteless solid, soluble in water and in dilute alcohol, destroyed by a temperature above about 72° C. Malt also contains a second ferment, *peptase*, which has the power of converting proteids into peptones. The chief use of malt is for brewing purposes. Medicinally, it is given in the form of an extract, prepared by evaporating an aqueous infusion *in vacuo*. Extract of malt is official in the U.S.P.

Note.—Taka-diastase is formed by the action of the fungus Eurotium oryzæ on steamed rice, and is used in Japan under the name of *koji*. It is a yellow-white powder, in action resembling saliva, and possesses high amylolytic properties. It is recommended as an artificial digestant.

Vinegar, "an acid liquid produced by the alcoholic and acetous fermentation of a vegetable juice or infusion," is largely prepared from malt, and is then known as malt vinegar. It is no longer included in the British Pharmacopœia.

PHALARIS.—Canary Seed.—The fruit of Phalaris canariensis, *Linn.*

N.O.—Graminaceæ.

Habitat.—Coasts of the Mediterranean.

Characters.—About one-sixth of an inch long, ovate or elliptic, flattened, enclosed by glossy, yellowish-grey paleæ, after the removal of which the

fruit is smooth and brownish and internally white. Inodorous, tasting slightly bitter.

Chemistry.—Starch, gluten, sugar, fat, etc.

Uses, etc.—Nutritive and emollient; has been used for poultices chiefly; employed as food for birds; has also been eaten by man.

JUNIPERI FRUCTUS.—Juniper Fruit.—The fruit of Juniperus communis, *Linn.*

N.O.—Coniferæ.

Syn.—Juniper berries.

Habitat.—England, etc.

Characters.—Nearly globular, about one-third of an inch in diameter, dark-purplish and covered with a whitish bloom; the short stalk at the base contains one or two whorls of small scales, and the apex is marked by three radiating furrows, which are surrounded by ridges, enclosing a triangular space. The three bony seeds are obovate in shape, triangular above, and imbedded in a brownish pulp, containing oil-cells. Odour aromatic and somewhat balsamic; taste sweet, terebinthinous, bitterish and slightly acrid.

Chemistry.—Volatile oil (1 to 2 per cent.), wax, resin, *juniperin* (resin-like), gum, sugar, mucilage, ash, etc.

Uses, etc.—For the production of the volatile oil (*see* Oleum Juniperi); occasionally made use of in the form of an infusion; largely used in the manufacture of gin.

Note.—The fruit of the Juniper is a *galbulus*, *i.e.*, a modification of the *strobilus* (cone with enlarged, fleshy scales.)

9. BARKS.—CORTICES.

General Histological Characters of Barks.—Bark may be defined as the aggregate of dead tissues covering the stems and roots of dicotyledonous shrubs and trees. Its formation is brought about by the activity of a cambium-like layer of cells (*cork-cambium*, or *phellogen*), which, by division, produces an impermeable layer of cork external to itself. Any tissues which may be thus cut off die, and, together with the cork itself, constitute the simplest form of bark. In a young stem the usual position of the primitive cork-cambium is sub-epidermal, and thus the epidermis only is exfoliated; but the cork-cambium may be originated somewhat deeper in the cortex, or in the epidermis itself. In a root, the usual seat of origin of cork is the layer of parenchyma (the pericycle) surrounding, and appertaining to, the central vascular tissue, and is therefore sub-cortical. Hence the whole of the cortex also is exfoliated, and, as in stems, the cork assumes the surface position. As a rule, a cork-cambium has only a limited duration of activity, and it is replaced by a new phellogenic layer in a more deep-seated position, formed in portions, like arcs to bows of the first-formed phellogen; this second phellogen is similarly replaced by another, still more deeply seated, and hence, outside the innermost and latest-formed cork-cambium there is a gradually increasing mass of dead tissues, composed of cork, cortex, and bast, and this constitutes the *bark*, as understood by the botanist. In popular usage the term has a somewhat broader significance, including all the tissues external to the true cambium of the vascular cylinder, and capable of being easily stripped off from it. In some stems the cork-cambiums are produced in regular sequence and at short intervals, and the resulting bark is laminate. However formed, these layers are gradually driven outwards by the increase in thickness of the stem or root, and at length crack and form a fissured bark, frequently composed of irregular scales, which gradually fall away by decay. The relative thinness of the bark of very old stems and branches is in part due to this gradual exfoliation of their outlying portions.

The outer layer of the cork usually has local interruptions in the form of pores, the so-called *lenticels*. These, which are best observed in young twigs, appear as bi-convex swellings of the periderm, and permit the interchange of gases with the atmosphere.

In distinguishing amongst barks the most important macroscopic characters to be noted are—the colour and texture, internal and external; the nature of the fracture (short or fibrous, etc.); the presence or absence of the periderm, of fungi, and of lichens. The barks made use of in

medicine are, in the majority of cases, those of stems, and the pieces may be in either quills or flat pieces, the quill condition being brought about by the shrinkage, through drying, of the inner and younger part of the bark.

General Chemical Characters of Barks.—The bark is sometimes regarded as being one of the receptacles for the excretory products of the plant, and the commonest form of the latter being some form of tannin, this body is almost invariably present In addition to this there are found many other substances, some of them highly useful in medicine, *e g.*, resins, volatile oils, bitter principles, alkaloids, glucosides, starch, colouring matters, etc.

WINTERI CORTEX.—Winter's Bark.—The bark of Drimys Winteri, *Forster.*

N.O.—Magnoliaceæ.

Habitat.—Antarctic America.

Characters.—In small, thick, curved pieces, one-tenth to a quarter of an inch thick; dull yellowish-grey externally, reddish-brown and rough internally, with aromatic odour and warm pungent taste. A transverse section exhibits radiating white lines, which are the ends of the bast rays, diverging towards the circumference in this manner. This feature distinguishes it from both Canella and Cinnamodendron barks. A decoction is darkened by a solution of ferric chloride.

Chemistry.—Volatile oil (containing *winterene* $C_{15}H_{24}$), tannin, resin, starch, etc.

Uses, etc.—Stimulant, aromatic tonic. *Dose.*—8 to 40 grains in powder or tincture.

Note.—Much of the so-called Winter's bark which has appeared in commerce from time to time has not been the bark of D. WINTERI. The barks of CINNAMODENDRON CORTICOSUM, of CANELLA ALBA, and of CROTON MALAMBO have been among the substitutions. The barks of several other species of Drimys, *e.g.*, D. CHILENSIS, D. AROMATICA, D. MEXICANA, D. GRANATENSIS, have similar properties to those of D. WINTERI.

MAGNOLIÆ CORTEX.—Magnolia Bark.—The bark of various species of Magnolia, *Linn.* (M. glauca, M. acuminata, M. tripetala, etc.).

N.O.—Magnoliaceæ.

Syn.—Swamp Sassafras.

Habitat.—United States of America.

Characters.—The bark of the young wood is quilled or curved, thin, externally orange-brown, with warts or fissures; internally whitish, thin, smooth; fracture short; inodorous; taste astringent, pungent, bitter. The bark from the old wood deprived of the cork is whitish, fibrous, and less pungent.

Chemistry.—A crystalline principle, *magnolin*, has been found in the bark of some of the species. It is insoluble in water, soluble in alcohol, ether, petroleum benzine, etc.

Uses, etc.—As a mild, stimulant, aromatic tonic and diaphoretic. *Dose.*—30 to 60 grains in decoction. Formerly official in the U.S.P.

Note.—The bark of the American *tulip-tree* (LIRIODENDRON TULIPIFERA) belongs to the same natural order as the above; contains a principle called *liriodendrin* or *tuliperin*. The properties of the bark are similar to those of Magnolia bark.

BERBERIS.—Barberry.—The bark of Berberis vulgaris, *Linn.*

N.O.—Berberidaceæ.

Habitat.—Europe, Asia.

Characters.—Thin, small, irregular pieces; externally yellowish-grey; internally nearly smooth and of an orange-yellow colour; taste bitter.

Chemistry.—The alkaloids, *berberine* (crystalline, yellow), *berbamine* (colourless), *oxycanthine* (colourless), and another. Tannin, wax, gum, etc., are also present.

Uses, etc.—Tonic; in large doses, purgative. *Dose.*—5 to 10 grains.

Note.—The root bark of B. ASIATICA (*Indian Barberry*) is light-coloured, corky, almost inodorous, with a bitter, mucilaginous taste; it contains much berberine, and an extract made from it is employed in India under the name of *Rusot*. The dried stem of B. ARISTATA is official in the Indian and Colonial Addendum.

The bark of B. AQUIFOLIUM (*Oregon grape root*) is used in some parts of America. It contains berberine and oxycanthine. Both this and other species of *Berberis* are official in the U.S.P. for the preparation of a fluid extract.

CANELLÆ CORTEX.—Canella Bark.—The bark of Canella alba, *Murray*, deprived of its corky layer and dried.

N.O.—Canellaceæ.

Syn.—White Wood or Wild Cinnamon.

Habitat.—Florida and West Indies.

Characters.—In quills or irregular pieces, which are generally more or less twisted and broken longitudinally; it has a pale orange-brown or buff colour externally, is commonly marked by roundish depressions or scars, and sometimes the remains of the corky layer may be seen here and there as silvery-grey patches; internally the colour is paler, being whitish or yellowish-white. It has an agreeable odour, somewhat resembling a mixture of cloves and cinnamon, and a pungent, bitter acrid taste.

Chemistry.—Volatile oil (containing eugenol) about 1 per cent., resin, starch, mannite, bitter principle, ash, etc. Tannin is absent.

Uses, etc.—As aromatic bitter. *Dose.*—10 to 40 grains in powder; given either alone or mixed with aloes (Pulvis Aloes et Canellæ B.P.C).

Note.—This bark has frequently been sold as Winter's bark.

CINNAMODENDRON CORTEX—Cinnamodendron Bark; False Winter's Bark.—The dried bark of Cinnamodendron corticosum, *Miers*.

N.O.—Canellaceæ.

Habitat.—Jamaica.

Characters.—Of a ferruginous grey-brown colour, darker upon the outer surface, spotted by scars of the nearly circular suberous warts; smooth and finely striated upon the inner surface, and almost agreeing in odour and pungent (not bitter) taste with Canella bark. Its decoction becomes black with ferric chloride.

Chemistry.—Probably the same as Canella alba, but contains in addition some tannin, hence it can easily be distinguished from Canella. Drimys bark also contains tannic acid, but an infusion of this is precipitated by barium nitrate and ferrous sulphate solutions. A cooled decoction causes with iodine an intense purple-brown colour, which Drimys bark does not.

Uses, etc.—Like Canella.

GOSSYPII RADICIS CORTEX.—Cotton Root Bark.

—The bark of the root of Gossypium herbaceum, *Linn.*, and of other species of Gossypium.

N.O.—Malvaceæ.

Habitat.—Asia and Africa.

Characters.—In thin flexible bands or quilled pieces; outer surface brownish-yellow, with slight longitudinal ridges or meshes, small black, circular dots or short transverse lines, and dull, brownish-orange patches from the abrasion of the thin cork; inner surface whitish, of a silky lustre, finely striate; bast fibres long, tough and separable into papery layers; inodorous; taste slightly acrid and faintly astringent.

Chemistry.—The bark contains a peculiar colourless, acrid resin, soluble in water, becoming insoluble and red in colour when oxidised.

Uses, etc.—Said to have properties similar to those of ergot. Official in the Indian and Colonial Addendum which includes a fluid extract and decoction. *Dose.*—30 to 60 grains.

The *B.P.C.* also contains Tinctura Gossypii.

CUSPARIÆ CORTEX.—Cusparia Bark.—

The dried bark of Cusparia febrifuga, *D.C.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 43].

N.O.—Rutaceæ.

Syn.—Angostura Bark.

Habitat.—Tropical South America.

B.P. Characters.—Occurs in flattened or curved pieces, or in quills, generally about four or five inches (ten or twelve centimetres) long, an inch (twenty-five millimetres) wide, and one-twelfth of an inch (two millimetres) thick. The outer layer usually consists of a grey or yellowish cork which is often soft and easily removed, disclosing a hard, dark-brown inner layer; the inner surface is light-brown and frequently laminated. The fracture is short and resinous; on the fractured surface many white points are visible. A transverse section exhibits numerous cells filled with acicular crystals of calcium oxalate and small oil glands, but seldom any sclerenchymatous tissue other than small isolated groups of bast fibres. Odour musty; taste bitter.

Chemistry.—Four alkaloids are present, viz., *galipine* (*galipeine*) $C_{20}H_{21}NO_3$; *galipidine* $C_{19}H_{19}NO_3$; *cusparine* $C_{20}H_{19}NO_3$; *cusparidine* $C_{19}H_{17}NO_3$. These are all crystallisable bases. Volatile oil (1·5 per cent.), resins, and a highly bitter principle *angosturin*, are also present.

Uses, etc.—As aromatic tonic; commercially as an ingredient of bitter liqueurs. *Dose.*—5 to 30 grains.

B.P. Preparations.

Infusum Cuspariæ	- - -	1 part in 20
Liquor Cuspariæ Concentratus	-	1 „ 2 of alcohol (20 per cent.)

B.P.C. Preparation.—Infusum Cuspariæ Concentratum.

SUBSTITUTIONS.—

(1). *A false Angostura Bark* is obtained from the STRYCHNOS NUX VOMICA tree, and has been found mixed with the true drug. This is a dangerous admixture since it contains the alkaloids of nux vomica, viz., strychnine, brucine, etc. The following tabulated statements show the difference between them :—

Character.	*True.*	*False.*
Thickness of pieces ...	One-sixteenth to one-eighth of an inch.	One-eighth of an inch or more.
External appearance ...	Reddish-brown colour; un-even; and covered with an ochrey-yellow scurfy, and friable cork, which is easily removed by the nail.	Grey, with bright, rust-coloured patches of cork and white warts.
Internal appearance ...	Lighter than exterior in colour, and smooth; separates in lamellæ.	Brown colour; not separable.
Fracture	Resinous and brilliant (from white striæ of crystals of calcium oxalate).	Smooth and somewhat black
Taste	Bitter, not lasting	Very bitter and lasting.
Odour	Aromatic, not agreeable... ...	None.
Behaviour in water, texture, etc.	Imbibes it freely, and soon becomes dry; fragile when dry; very light; rather spongy.	Remains hard in water; difficult to break; very heavy, compact, and is cut with difficulty.
With nitric acid	Deep brownish-red; or like venous blood (absence of brucine).	Arterial blood-red (presence of brucine).

(2). *Copalchi Bark*, which has occasionally been met with since 1855, is the bark of CROTON species, probably Pseudochina (*N.O.*—Euphorbiaceæ. *Hab.*—Mexico). Externally consists of a loose, thin, greyish, papery, suberous layer, which, when removed, exhibits transverse pits like the lines of a file; its fracture is short; taste like cascarilla. There is present in this bark a little volatile oil, bitter principle, and an alkaloid which gives the thalleioquin test characteristic of quinine and quinidine; it does not, however, yield herapathite.*

(3). *Brazilian Angostura Bark* is the bark of ESENBECKIA FEBRIFUGA (*N.O.*—Rutaceæ). Externally it is grey-brown or with light rust-brown patches, internally dark brown; fracture short, fibrous; taste bitter, not aromatic; contains *evodine* (*esenbeckine*).

(4). Recently (1894-5) a bark (origin untraced) has been met with as a substitution of angostura bark which has the following characters :—In flat or slightly incurved pieces, of varying length and width, and from one-sixteenth to one-eighth, or rarely as much as three-eighths of an inch, in thickness. The outer surface of a grey-brown colour, rough from the presence of many wart-like excrescenses of the periderm, and frequently bearing closely adherent lichens of a yellow or a yellowish-red colour, marked with numerous black spots; beneath the corky layer the colour is dark greenish-grey. The inner surface is coarsely striated longitudinally, and in colour yellow, yellowish-brown, and brown. Fracture hard, brittle, showing numerous closely adherent concentric laminæ. A transverse section under the microscope shows numerous concentrically arranged large groups of sclerenchymatous cells.

This bark again appeared in commerce in 1902 and is fully described by Pollard [P.J. 1903 (2) p. 153] who found it to contain 1·3 per cent. of bitter amorphous alkaloid.

*(*See* also note to Cascarillæ Cortex).

XANTHOXYLUM.—Prickly Ash.—The dried bark of (1) Xanthoxylum americanum, *Miller* (Northern Prickly Ash) or of (2) Fagara Clava-Herculis, *Small* (Southern Prickly Ash).

N.O.—Rutaceæ.

Habitat.—North America.

Characters.—(1) In thin curved or quilled fragments. Externally brownish-grey, with whitish patches and minute black dots, with some brown, glossy, straight, two-edged spines, about a quarter of an inch long; internally whitish, smooth. Fracture short; inodorous, bitterish; very pungent. (2) Resembles the preceding, but is thicker, and marked by many conical, corky projections, sometimes four-fifths of an inch high, and by stout, brown spines rising from a corky base. Xanthoxylum should not be confounded with the bark of Aralia spinosa, which is nearly smooth externally and beset with slender prickles in transverse rows.

Chemistry.—*Xanthoxylin* (a crystalline principle, bright red with H_2SO_4), alkaloid (probably berberine), tannin, sugar, ash, etc. The xanthoxylins

isolated from the above two barks have recently been shown to be different chemically.

Uses, etc.—Internally and externally as stimulant; resembles mezereon in action. *Dose.*—20 to 60 grains in powder. Included in the U.S.P. for the production of a fluid extract.

SIMARUBÆ CORTEX.—Simaruba Bark, Mountain Damson Bark.

—The dried root-bark of Simaruba amara, *Aublet* (S. officinalis), or of S. glauca, *D.C.* (S. medicinalis).

N.O.—Simarubaceæ.

Habitat.—Jamaica and South America.

Characters.—In broad, folded, very fibrous pieces, several feet long, which are externally rough, warty, and marked with transverse ridges, externally greyish or whitish-yellow in colour; internally pale yellowish-white and striate. Very frequently the outer bark has been removed, when the external surface is pale-yellowish or pinkish-brown, and marked by fine paler lines due to bast fibres. The liber is very tough, fibrous, and difficult to break transversely. Taste very bitter.

Chemistry.—Recent investigation has shown the presence of fixed oil, resin, a crystalline principle $C_{22}H_{30}O_9$, a crystalline non-bitter substance and a fluorescent principle.

Uses, etc.—A bitter tonic. *Dose.*—5 to 20 grains in infusion.

Note.—The bark of Samadera indica, containing a bitter principle, *samaderin*, has similar properties to the above. *Honduras bark* (Cascara amarga) belongs to an undetermined species of Picramnia; it contains a sweet-bitter amorphous alkaloid.

SOYMIDÆ CORTEX.—Rotun Bark.

—The bark of Soymida febrifuga, *Juss.*

N.O.—Cedrelaceæ.

Habitat.—India (Malabar, etc.).

Characters.—Occurs in compact, thick, fibrous pieces, of a rusty-grey or brown colour, and bitter astringent taste. The inner side and edges are usually of a bright, reddish-brown colour.

Chemistry.—Tannic and gallic acids and a bitter amorphous principle.

Uses, etc.—As astringent, tonic, and antiperiodic. *Dose.*—60 grains in dysentery, etc.

AZADIRACHTÆ CORTEX.—Nim or Neem Bark.

—The bark of Melia Azadirachta, *Linn.*

N.O.—Meliaceæ.

Syn.—Margosa bark.

Habitat.—India.

Characters.—Varying in appearance according to the size and age of the tree producing it. The bark from the trunk of a tree above three or four years of age is covered with a thick, scaly epidermis, and varies in thickness from one-fourth to one-half an inch. That from the smaller branches is smooth, of a dullish purple colour, marked by longitudinal lines of ash-coloured epidermis, from one-eighth to one-twelfth of an inch apart. Inner layer of bark of a whitish colour in the fresh state, powerfully bitter, but less astringent than the outer dark-coloured layer.

Chemistry.—*Margosin* (a crystallizable principle) and *catechin* (an astringent).

Uses, etc.—Official in the Indian and Colonial Addendum for the preparation of a tincture. *Dose.*—60 grains, given in powder, decoction and tincture. Has astringent, tonic and antiperiodic properties.

Note.—MELIA AZEDARACH.—The bark of the root of this small American tree, cultivated in many parts of India, is used in America as an anthelmintic and emetic. It was formerly included the U.S.P. *Margosa Oil* is extracted from the seeds of Melia Azadirachta, it is used in India as an anthelmintic and externally in rheumatism.

PRINOS.—Black Alder.—The bark of Ilex verticillata, *A. Gray.* (Prinos verticillatus.)

N.O.—Aquifoliaceæ

Syn.—Winter-berry; fever-bush.

Habitat.—United States of America.

Characters.—Thin, slender fragments, about one-twenty-fifth of an inch thick, fragile; outer surface brownish-ash coloured, with whitish patches and blackish dots and lines, the corky layer easily separating from the green tissue; inner surface pale-greenish or yellowish; fracture short, tangentially striate; nearly inodorous, bitter, slightly astringent.

Chemistry.—Contains tannic acid, but no berberine. The yellow colouring matter and bitter principle have not been isolated.

Uses, etc.—Astringent, tonic, febrifuge, etc. *Dose.*—30 to 60 grains in decoction.

Note.—The bark of Alnus glutinosa (N.O. Betulaceæ), the common Alder has been used in medicine on account of its astringent qualities.

EUONYMI CORTEX.—Euonymus Bark.—

The dried root-bark of Euonymus atropurpureus, *Jacquin* [*Sargent, Silva*, vol. ii. tab. liii].

N.O.—Celastraceæ.

Syn.—Wahoo Bark.

Habitat.—North America.

B.P. Characters.—In quilled or curved pieces, varying in thickness from one-twelfth to one-sixth of an inch (two to four millimetres). The outer layer is a soft friable cork of a light ash-grey colour, marked with darker patches. The inner surface is pale tawny white and smooth, when free from fragments of the white wood. The bark breaks with a short fracture; the fractured surface is yellowish in colour. Odour faint but characteristic; taste somewhat mucilaginous and afterwards bitter and slightly acrid.

Chemistry.—*Euonymin* (neutral, amorphous, bitter, soluble in ether, alcohol and water), *euonic acid*, resins, fat, extractive, dulcitol, etc., ash 14 per cent.

Uses, etc.—As tonic, diuretic, laxative and hepatic stimulant.

B.P. Preparation.

Extractum Euonymi Siccum, prepared with alcohol (45 per cent.) and containing Calcium Phosphate.

B.P.C. Preparations.—Tinctura Euonymi, Elixir Euonymi Comp., Liquor Euonymini, etc.

Note.—Dried extract of Euonymus is commonly known as Euonymin. Euonymin was the name originally given to the precipitated resinoid by the eclectics; it must not be confounded with the active principle of the bark.

CASCARA SAGRADA.—Cascara Sagrada.

The dried bark of Rhamnus purshianus, *D.C.* [*Sargent. Silva*, vol. ii. plate 62].

N.O.—Rhamnaceæ.

Syns.—Rhamni Purshiani Cortex; Sacred Bark; Chittem Bark.

Habitat.—North America.

B.P. Characters.—In quilled, channelled, or nearly flat pieces frequently about four inches (ten centimetres) long, three quarters of an inch (eighteen millimetres) wide, and about one-sixteenth of an inch (one millimetre and a half) thick. It possesses a nearly smooth, dark, purplish-brown cork, marked with scattered transversely elongated lenticels, but usually more or less covered with patches of silvery-grey lichen; and when these are removed the exposed cork is of a brownish-red colour. The inner surface is reddish-brown with faint transverse corrugations, and longitudinal striations. The fracture is short, and near the inner surface somewhat fibrous. The bark has a characteristic but not powerful odour, and a persistent, nauseous, and bitter taste.

Chemistry.—*Emodin* and several resins, one or more of which is bitter. It has been stated that the bark contains a fermentable glucoside *purshianin*, yielding emodin and a sugar on hydrolysis. From later investigations, however, it appears probable that no emodin-yielding glucoside is present, and that while *purshianin* may be active, it is not a pure principle. An acetic ether extract ot the precipitate produced with lead subacetate has been found to contain a purging principle, which however, attempts failed to isolate.

Note.—The bark gives an orange-red colour with alkalies. It is stated that the bark loses griping qualities on keeping, owing, presumably, to the presence of evanescent ferment; for this reason it is regarded as being best fitted for medicinal use after the lapse of one or two years.

Uses, etc.—Tonic, laxative, etc. *Dose.*—10 to 60 grains in powder.

B.P. Preparations.

Extractum Cascaræ Sagradæ - - aqueous; dried; yield, 25 to 30 per cent.

Extractum Cascaræ Sagradæ Liquidum - 1 part in 1.

Used in preparing

Syrupus Cascaræ Aromaticus.

B.P.C. Preparations.—Extractum Cascaræ Miscible, rendered less bitter by heating with caustic potash (other tasteless extracts are prepared from powdered bark previously macerated with magnesia or lime), Elixir Cascaræ, Elixir Cascaræ et Euonymini, Mistura Cascaræ Sagradæ Comp., etc.

Note.—There are four species of Rhamnus growing in California, viz., R. ALNIFOLIA, R. CROCEA (*Californian mountain holly*), R. PURSHIANUS and R. CALIFORNICA (*Californian buckthorn*). The bark of the last-named much resembles that of the official species in appearance, and all the species have allied medicinal properties. The bark of R. WIGHTII is used in India

RHAMNI FRANGULÆ CORTEX.—Frangula Bark.

The dried bark of Rhamnus Frangula, *Linn.* Collected from the young trunk and moderate-sized branches, and kept at least one year before being used.

N.O.—Rhamnaceæ.

Syn.—Cortex Frangulæ; Alder Buckthorn Bark.

Habitat.—Holland.

Characters.—In small quills, the bark itself being one-twenty-fifth of an inch or somewhat more in thickness, and covered with a greyish-brown or blackish-brown corky layer marked with transverse whitish lenticels; inner surface smooth, brownish-yellow; fracture short and purplish externally, but somewhat fibrous and yellowish within. No marked odour; taste pleasant, sweetish, and slightly bitter.

Chemistry.—*Frangulin*, $C_{21}H_{20}O_9$ (*rhamnoxanthin*), which is soluble in carbon bisulphide, alcohol and ether; there are also two resins, one soluble in ether and the other insoluble in that solvent, but soluble in alcohol; a little tannic acid; extractive; and *emodin*, identical with that present in rhubarb root. Frangulin (trioxymethyl anthraquinone) is a glucoside yielding on hydrolysis *emodin* ($C_{15}H_{10}O_5$) and a sugar called *rhamnose* ($C_6H_{10}O_5$). Frangula-emodin is distinguishable from other emodins, *e.g.*, aloe-emodin, by colour reaction with sulphuric acid.

Uses, etc.—Tonic and laxative; formerly official. The B.P.C. includes a fluid extract. *Dose.*—10 to grains.

Note.—If this bark is used before the proper time it is said to produce sickness and diarrhœa, this action being probably due to the presence of a ferment. The fruit of the shrub is not unlike that of R. CATHARTICUS, but has only two or three roundish angular seeds. The leaves of this plant are entire; the calyx, too, is five-partite, while the leaves of Rhamnus catharticus are serrate and the calyx four cleft.

HIPPOCASTANI CORTEX.—Horse-chestnut Bark.

The bark of Æsculus Hippocastanum, *Linn.*

N.O.—Sapindaceæ.

Habitat.—Persia and India; cultivated in Europe.

Characters.—Thin, externally brown-grey, with small scattered warts showing opposite leaf-scars, which bear on their lower rounded margin five or seven small warts. Inner surface smooth and whitish, internal colour brownish; inner bark tough, breaking with a fibrous fracture; odour slight; taste bitter and astringent.

Chemistry.—*Æsculin*, $C_{15}H_{16}O_9$ and *fraxin* (*paviin*), $C_{16}H_{18}O_{10}$. Æsculin is white, crystalline, soluble in water, showing a bluish fluorescence, increased by the presence of an alkali; it is a glucoside yielding æsculetin (a dioxy-coumarin) and sugar as hydrolytic products.

Note.—The cotyledons of the seed contain 2 to 4 per cent. of a bland fixed oil, *oleum hippocastani.*

ERYTHROPHLŒUM.—Sassy Bark.—

The dried bark of Erythrophlœum guineense, *Don.*

N.O.—Leguminosæ.

Syn.—Mancona bark.

Habitat.—West and Central Africa.

Characters.—Flat or curved, about one-quarter of an inch thick; externally warty; fissured, red-brown, hard; fracture coarsely granular and fibrous; inodorous, astringent, bitter and acrid.

Chemistry.—The alkaloid *erythrophleine*, tannin, gallic acids, resin, gum, red colouring matter, etc.

Uses, etc.—A West African arrow and ordeal poison; introduced as a heart tonic; has also astringent and analgesic properties. The B.P.C. has a tincture (1 in 10 of alcohol, 90 per cent.), and the hydrochloride of the alkaloid has also been used.

PISCIDIA.—Jamaica Dogwood.—The bark of Piscidia erythrina, *Jacq.*

N.O.—Leguminosæ.

Habitat.—West Indies.

Characters.—In pieces of two to four inches in length, and from one to two inches wide, and about one-eighth of an inch in thickness. The outer surface of some of the pieces is of a dark grey-brown colour, others of a yellow-brown. The bark is frequently studded with flattened protuberances of a lighter colour than the surrounding cork. The central part of the bark is much lighter coloured, and when wet or freshly-broken is of a peculiar blue-green colour. The inner part of the bark is of a dark-brown colour and very fibrous. It has a strong, disagreeable opium-like odour when broken. Taste bitter and acrid, producing a burning sensation in the mouth and pharynx.

Chemistry.—*Piscidin* (neutral, colourless, crystalline, insoluble in water), resin, fat, etc.

Uses, etc.—As sudorific, narcotic and anodyne. The B.P.C. includes a fluid extract. *Dose.*—15 to 45 grains in fluid extract, etc. Has been employed for catching fish on account of its stupefying properties.

PRUNI VIRGINIANÆ CORTEX.—Virginian Prune Bark.—The bark of Prunus serotina, *Ehrh.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 97], collected in autumn.

N.O.—Rosaceæ.

Syn.—Wild Cherry Bark.

Habitat.—United States of America.

B.P. Characters.—In curved pieces or irregular fragments one-twelfth of an inch (two millimetres) or more in thickness. Young bark is frequently covered with a smooth, thin, reddish-brown, papery cork, or, if this has been removed, exhibits a greenish-brown inner layer; it is marked with transversely elongated lenticels, and breaks with a short granular fracture. The outer surface of old bark is usually rough, and nut-brown in colour. The inner surface is finely striated or fissured and reticulated; the fractured surface is reddish-grey. The bark contains numerous groups of sclerenchymatous cells of characteristic irregular shape. Taste astringent, aromatic, and bitter; the odour, which is developed upon maceration in water, resembles that of the bitter almond.

Chemistry.—Tannic acid, gallic acid, resin, bitter principle (fluorescent glucoside), and starch; and by distillation yields, as a result of the decomposition of *amygdalin* or allied glucoside by an enzyme, a volatile oil containing hydrocyanic acid, similar to the volatile oil of bitter almonds.

Uses, etc.—Mild sedative, etc. Official also in the U.S.P., which includes a fluid extract and syrup.

B.P. Preparations.

Syrupus Pruni Virginianæ.

Tinctura Pruni Virginianæ, 1 in 5 of alcohol and water.

B.P.C. Preparations.—Extractum Pruni Virginianæ Liquidum, Infusum Pruni Virginianæ, etc.

QUILLAIÆ CORTEX.—Quillaia Bark.—The inner part of the bark of Quillaja saponaria, *Molina* [*Bot. Mag.* plate 7568].

N.O.—Rosaceæ.

Syns.—Panama Bark; Soap Bark.

Habitat.—Peru and Chili.

B.P. Characters.—Quillaia Bark is usually imported in large flat pieces, about one-sixth of an inch (four millimetres) thick, and two feet (six decimetres) or more long, and four inches (ten centimetres) wide. The outer surface is brownish-white, or, where the outer bark has been imperfectly removed, reddish-brown or blackish-brown; the inner surface is smooth, and white or yellowish-white. The fracture is splintery; the fractured surface is laminated, and exhibits under a lens glistening prismatic crystals; the transverse section is marked with fine radial and tangential lines. The taste is astringent and acrid; the odour is not marked, but the powder is extremely irritating to the nostrils.

Chemistry.—The most important proximate constituent of the bark is the body called *saponin*, which, is a mixture of two glucosides *quillaic acid* ($C_{19}H_{30}O_{10}$) and *quillaia-sapotoxin* ($C_{17}H_{26}O_{10}$). These are closely allied to the polygalic acid and senegin of Senega Root. Quillaia-sapotoxin is poisonous and strongly sternutatory, both this and quillaic acid possess marked foam-producing properties. Crystals of calcium oxalate and sulphate are present in the bark.

Uses, etc.—As stimulant, diuretic, and irritant; as source of saponin. *Dose.*—15 to 30 grains in infusion.

B.P. Preparations.

Liquor Picis Carbonis.

Tinctura Quillaiæ - 1 in 20 of alcohol (60 per cent.).

Note.—The U.S.P. includes a fluid extract.

RUBUS.—Blackberry Bark.—The bark of the root of Rubus villosus, *Aiton*, R. nigrobaccus, *Bailey*, and cuneifolius, *Pursh*.

N.O.—Rosaceæ.

Habitat.—United States of America (R. villosus is a European species).

Characters.—In thin, tough, flexible bands, outer surface blackish or blackish-grey, inner surface pale-brownish, sometimes with strips of whitish, tasteless wood adhering; inodorous, strongly astringent, somewhat bitter.

Chemistry.—Tannic acid is an abundant constituent (10 per cent.).

Uses, etc.—As astringent and tonic. *Dose.*—20 to 30 grains. The U.S.P. includes a fluid extract and syrup.

HAMAMELIDIS CORTEX.—Hamamelis Bark.

—The dried bark of Hamamelis virginiana, *Linn.* [*Bot. Mag.* plate 6683].

N.O.—Hamamelaceæ.

Syn.—Witch Hazel Bark.

Habitat.—Canada and United States.

B.P. Characters.—Usually in curved pieces about one-sixteenth of an inch (one and a half millimetres) thick, and varying from two to eight inches (one-half to two decimetres) in length, sometimes covered with a silvery-grey or dark-grey scaly cork marked with transverse lenticels, but frequently freed from the cork, and then exhibiting a nearly smooth reddish-brown outer surface. The inner surface is pale reddish-pink in colour, and finely striated longitudinally; the fracture is laminated and coarsely fibrous. The bark has an astringent taste, but no marked odour. The transverse section exhibits a complete ring of sclerenchymatous cells and numerous tangentially elongated groups of bast fibres.

Chemistry.—*Hamamelitannin* ($C_{14}H_4O_9,5H_2O$) entirely convertible into gallic acid and a sugar, gallic acid, esters of phytosterol and a trace of volatile oil.

Uses, etc.—As tonic and astringent. *Dose.*—30 to 50 grains.

B.P. Preparation.

Tinctura Hamamelidis - -	1 part in 10 of alcohol (45 per cent.).

Preparations other than B.P.—"*Hamamelin*" is a dried and powdered alcoholic extract (Ext. Hamamelidis B.P.C.). The U.S.P. orders an "Aqua Hamamelidis" distilled from the bark.

GRANATI CORTEX.—Pomegranate Bark.

The dried bark of the stem and root of Punica Granatum, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 113].

N.O.—Granataceæ.

Habitat.—South of Europe, S. W. Asia.

B.P. Characters.—Usually in irregular curved or channelled pieces varying from two to four inches (half to one decimetre) in length, and from half an inch to one inch (twelve to twenty-five millimetres) in width. The outer surface of the root-bark

is rough, yellowish-grey, and marked with irregular conchoidal depressions, the stem-bark being smoother and frequently bearing minute lichens; the inner surface is yellow, more or less tinged with brown. The fracture is short, the fractured surface pale in colour. The transverse section exhibits numerous fine radial and tangential lines. The bark has an astringent, very slightly bitter taste.

Chemistry.—*Punico-tannic acid* (22 per cent.), *mannite* (*punicin*), and the alkaloids *pelletierine* (*punicine*) $C_8H_{15}NO$, *methyl-pelletierine*, *pseudo-pelletierine*, and *isopelletierine*. Pelletierine is the most important constituent, is liquid, boils at 125° C., and is soluble in water, alcohol, ether, and chloroform.

Uses, etc.—As astringent and anthelmintic. *Dose.*—10 to 30 grains.

B.P. Preparation.

Decoctum Granati Corticis - - - 1 part in 5.

Note.—The sulphate and tannate of pelletierine (not pure) are used in medicine. The total alkaloidal content of the bark may be as high as 3 per cent., that of root bark somewhat higher. The drug deteriorates on keeping.

Adulterations.—*Barberry bark* (*N.O.*—Berberidaceæ) and the bark of the Box-tree (Buxus sempervirens, *N.O.*—Euphorbiaceæ), both of which are not astringent but are decidedly bitter. A decoction of these gives no blackening with a solution of ferric chloride.

CORNUS.—Dogwood.—The bark of the root of Cornus florida, *Linn.*

N.O.—Cornaceæ.

Habitat.—Canada and United States of America.

Characters.—In curved pieces of various sizes about one-eighth of an inch thick; deprived of the furrowed brown-grey corky layer; outer and inner surface pale reddish, or light reddish-brown, striate; transverse and longitudinal fracture short, whitish, with brownish-yellow striæ; inodorous; astringent and bitter.

Chemistry.—*Cornin* (a neutral crystalline principle), bitter extractive, resin, tannic and gallic acids (3 per cent.) and salts.

Uses, etc.—As tonic and astringent; introduced as a remedy in intermittent fevers.

Note.—The *round-leaved dogwood* (CORNUS CIRCINATA) and the *swamp dogwood* (C. SERICEA) have barks with similar properties to the above.

VIBURNUM PRUNIFOLIUM.—Black Haw.—The bark of Viburnum prunifolium, *Linn.*, or of V. Lintago, *Linn.*

N.O.—Caprifoliaceæ.

Habitat.—United States of America.

Characters.—In thin pieces or quills, glossy, purplish-brown, with scattered warts and minute black dots; when collected from old wood, greyish-brown; the thin corky layer easily removed from the green layer; inner surface whitish, smooth; fracture short; inodorous, somewhat astringent and bitter.

Chemistry.—*Viburnin* (a resin), valerianic (*viburnic*) acid, the common vegetable acids, including tannic acid, salts of calcium and potassium.

Uses, etc.—Diuretic, tonic, etc. *Dose.*—30 to 60 grains. Official in the Indian and Colonial Addendum and the U.S.P. for the production of a fluid extract, the B.P.C. has an elixir and compound elixir.

VIBURNUM OPULUS.—Cramp Bark.—The bark of Viburnum Opulus, *Linn.*

N.O.—Caprifoliaceæ.

Habitat.—N. Europe, etc.

Characters.—The bark occurs in flattish or curved bands or occasionally in quills; outer surface ash-grey marked with scattered somewhat transversely elongated warts of a brownish colour, and more or less marked with blackish dots and longitudinal, black irregular lines on their ridges; inner surface dingy-white or brownish; fracture tough, tissue separating in layers; inodorous, taste somewhat astringent and bitter.

Chemistry and uses.—Essentially similar to those of V. prunifolium.

Note.—V. Opulus is the common Guelder Rose or Snowball tree.

YOHIMBI CORTEX.—Yohimbehe Bark.—The bark of Corynanthe yohimbi, *Schum.*

N.O.—Rubiaceæ.

Syn.—Yumbehoa Bark.

Habitat.—E. Africa.

Chemistry.—Four alkaloids have been described:—*Yohimbine* (*corynine*), *yohimbenine* (*corynanthine*), and two others; the therapeutical properties of the bark are due to the first-named, which is an article of commerce.

Uses.—As an aphrodisiac. *Dose.*—Of Yohimbine, $\frac{1}{20}$ to $\frac{1}{6}$ grain.

CINCHONÆ CORTICES.—Cinchona Barks.—The dried bark of Cinchona Calisaya, Cinchona officinalis, Cinchona succirubra, Cinchona lancifolia, and other species and hybrid species of Cinchona, from which the peculiar alkaloids of the bark may be obtained. Some species of Remijia may be used for obtaining salts of quinine and cinchonine.

N.O.—Rubiaceæ.

Syn.—The Countess' powder; Jesuits' bark (Pulvis Jesuiticus); Lignum Febrium; Pulvis Patrum; Cortex Chinæ (P.L. 1677); Chinchona bark; Quinquina (F.); Cortex Chinæ (P.G.); Quina, which is the Peruvian term for *bark*, is equivalent to the Spanish *cascarillo* and the South American *cascara*.

Habitats.—These evergreen trees or shrubs are indigenous to the mountainous districts of South America (Andes), but are largely cultivated with success in India (Neilgherry Hills), Ceylon, Java, and more recently in South America (Bolivia) itself.

Collection.—In South America the trees are felled and stripped. The small quills from the twigs and branches are dried in the sun, and the large pieces from the trunk are removed and piled in layers, crossing each other at right angles, pressed down with weights, and dried by exposure. The periderm of the calisaya variety is removed by beating with mallets. The *serons* used for packing the bark for exportation consist of fresh hides, which, by contracting as they dry, form a firm package. In India, Ceylon and Java there are several methods of obtaining the bark. (1) *Karsten's method* (mossing).—Removal of narrow longitudinal strips, and covering the trunk with moss. The bark grows again, and becomes *renewed bark*. (2) *Coppicing.*—After cutting the tree down above the root, and removing the bark, the remaining stumps develop shoots, from which the bark may be removed in a few years. (3) *Moen's method* (shaving).—The *outer layers* of bark are removed by a spokeshave, and the denuded part protected by grass, moss, or other means.

Medical History.—Associated with its introduction as a medicine are the Countess of Cinchon (1638), Chifflet (1653, circa), and the Jesuit Fathers (1655). It was known in England in 1655, and appears in the London Pharmacopœia of 1677.

Botanical History.—Linnæus gave this genus the name of Cinchona in honour of the Countess of Cinchon, who is said to have introduced the bark into Europe in 1638. La Condamine first described the plant in 1737. Other personal observers were Jussieu (1739); Mutis (1772); Ruiz and Pavon (1777); Humboldt and Bonpland (1792); Poppig (1832); Weddell (1846); and, more recently, Markham and others. Other genera closely allied to the Cinchonas are:—Exostemma, Buena, and Cascarilla. There are about thirty species of Cinchona, and the following are considered to be the most valuable:—

(1). Cinchona calisaya, *Wedd.* (yielding *yellow bark*).
(2). Cinchona ledgeriana, *Moens* (yielding *ledger bark*).
(3). Cinchona officinalis, *Linn., var.* (*a*) Condaminea, (*b*) Bonplandia, (*c*) Crispa yielding *crown* or *Loxa bark*.
(4). Cinchona succirubra, *Pav.* (yielding *red bark*).
(5). Cinchona lancifolia, *Mutis.*, Cinchona cordifolia (yielding *Colombian, Carthagena*, or *Coquetta bark*).

The average altitude is 5,000 to 8,000 feet above sea level. (1) Cinchona calisaya, a lofty tree, with trunk two or more feet in diameter, growing in the warmest woods at a height of 6,000 to 7,000 feet above sea level. Leaves variable in form, three to six inches long; flowers pinkish, in large pyramidal panicles, fragrant; fruit, a capsule dehiscing from below upwards (characteristic of the genus). (2) Cinchona ledgeriana is regarded by some as a variety of calisaya. (3) Cinchona officinalis, formerly Cinchona condaminea, *var.* (*a*) crispa, (*b*) chahuarguera (B.P., 1867) is a large tree, having lanceolate or ovate leaves, usually pointed, glabrous and shining; flowers small, pubescent, and in short lax panicles; fruit half-inch or more in length; the source of the crown bark of Loxa. (4) Cinchona succirubra, 50 to 80 feet high; leaves broadly ovate, about 12 inches long, pubescent beneath; flowers in terminal panicles; rose-coloured (5) Cinchona lancifolia.—*See* tabulated scheme, pp. 184 and 185.

Commercial History.—Almost exclusively obtained in early times from Loxa, shipped at Payta, whence to Spain, and thence spread all over Europe. Supplies came to England first about 1655. In 1753 it was found in New Granada; in 1776 Huanuco was an additional source, and since this period, barks were, and are still, shipped from the ports of Guayaquil, Payta, Lima, Arica, Buenos Ayres, Carthagena, and Santa Martha. Attempts were made in 1737 to transplant the Cinchonas, but without much success. Condamine (1737), Ruiz (1792), Fée (1824), Fritze (1837), Royle (1837), Miquel (1846), Weddell (1848); each advised Cinchona cultivation in other parts of the world, and in 1852-6, Hasskarl, for the Dutch Government, sent some plants and seeds to Java, where their

cultivation was commenced. In 1859, Markham, for the British Government, sent plants to India (the Neilgherry Hills), Ceylon, and other places, where the plants have flourished. Later Ledger obtained seeds which went to India and Java; in India the experiment was a failure, but in Java the seeds, by careful cultivation and selection, yielded the variety of Calisaya, now known as C. Ledgeriana, yielding a high percentage of Quinine, and now grown on the island to an enormous extent.

Common Characters of Cinchona Barks.—While the difficulty of distinguishing amongst the varieties of Cinchona barks is often considerable, if not insurmountable, there are certain characters by means of which a Cinchona bark may be known as such. "The shape of the commercial bark depends upon its treatment during the drying process, and the cultivated bark is generally seen in fairly uniform quills. The outer surface of the bark of old wood is influenced in appearance by the presence or absence of the corky layer, which, in some species, is easily detected. The inner surface, if not torn, always presents a striate appearance, which is coarser or finer, according to the relative thickness of the bast fibres and their arrangement. The size, arrangement, and relative number of the latter impart to the transverse fracture its peculiar character, and the almost complete absence of these in younger barks causes them to break with a smooth fracture. The density of Cinchona barks varies considerably, but, according to Arnaud, is, in most cases, less than that of water; Calisaya bark is, however, slightly heavier than water. The most important microscopical characteristics of Cinchona barks are due to their bast or liber fibres, which are never branched, are rather short, with their ends obtusely pointed, of a rather quadrangular appearance upon the transverse section under the microscope, showing the secondary deposits on the cell walls by which the central cavity has been almost closed."—*Stillé* and *Maisch*.

Chemical History.—Passing over the early attempts of Fourcroy, Westring, Seguin, Deschamps, Vauquelin, Reuss, Gomez, Laubert, and Dr. Duncan to isolate the active principles of this bark, we find, in 1820, Pelletier and Caventou confirm Gomez and Laubert's discovery of Cinchonine. They discovered quinine in Calisaya bark. Henry and Delondre (1833) and Winckler (1844) discovered quinidine; Pasteur (1853) discovered cinchonidine; he also showed that quinine and quinidine were isomeric, and that cinchonine and cinchonidine were also isomeric.

Chemistry.—The cinchona and allied barks contain upwards of thirty natural alkaloids, in addition several others have been obtained artificially from these. The four most important alkaloids are *Quinine*, *Quinidine*, *Cinchonine* and *Cinchonidine*. (See below.) The following is a list of the other natural Cinchona alkaloids:—*Quinamine*, *quinamidine* (*conquinamine*), *cupreine*, *homoquinine* (*ultraquinine*), *hydroquinine*, *hydroquinidine*, *hydrocinchonine*, *hydrocinchonidine* (*cinchamidine*), *homocinchonidine*, *cinchonamine*, *paytine*, *cusconine*, *concusconine*, *cusconidine*, *aricine* (*cinchovatine*), *paricine*, *paytamine*, *dihomocinchonine*, *dicinchonine*, *diquinidine* (*dicinchonine*), *javanine*, *cincholine*, *chairamine*, *conchairamine*, *chairamidine*, *conchairamidine*. The following are the chief artificial alkaloids:—*Quinicine*, *diquinicine*, *cinchonicine*, *dicinchonicine*, *quinamicine*, *protoquinamicine*, *apoquinamine*, *homocinchonicine*.

The other constituents of the bark are:—*Quinic acid*, $C_7H_{12}O_6$ (*cinchonic*, *kinic acid*), occuring in the bark as calcium

Tabulated Characters of the chief Cinchona Barks.

	Loxa, Pale or Crown.	*Yellow.*	*Red.*	*Columbian or Carthagena.*
Botanical Source	C. OFFICINALIS	C. CALISAYA and C. LEDGERIANA.	C. SUCCIRUBRA	C. LANCIFOLIA.
Habitat	Loxa in Ecuador (Huanuco, Jæn, Huamilies); cultivated in India, etc.	Bolivia and South Peru, largely cultivated in Java and India.	Cultivated in India, Ceylon and Java; also imported from South America.	Botoga (New Granada).
Part used, and how met with.	Whole bark in single or double quills.	Quills usually, rarely flat	Coated quills, or incurved pieces.	Fine large quills, or thick, flattish, or curved pieces (half quills).
Thickness	$\frac{1}{24}$ to $\frac{1}{12}$ inch	$\frac{1}{8}$ to $\frac{1}{3}$ inch	$\frac{1}{10}$ to $\frac{1}{4}$ inch	$\frac{3}{4}$ inch.
Length	6 to 15 inches	6 to 18 inches	2 to 12 inches or more ..	1 or 2 to 21 inches.
Diameter or width ..	$\frac{1}{8}$ to $\frac{2}{3}$ inch; not larger than the finger.	Pieces, 1 to 3 inches; quills as large as the thumb.	$\frac{1}{2}$ to 2 inches	Pieces, 4 to 5 inches; quills, $\frac{1}{4}$ to $1\frac{1}{2}$ inch.
Texture	Brittle, easily splitting longitudinally.	Compact and heavy ..	Somewhat spongy ..	Soft, spongy.
Transverse Fracture ..	Short	Shortly and finely fibrous	In smaller quills, nearly close; in larger quills, finely fibrous.	Very fibrous.
Interior	Bright orange or cinnamon-brown.	Tawny-yellow; fibrous ..	Brown red, or deep reddish-brown; irregularly and coarsely striated.	Stringy, very fibrous, reddish-brown or orange-red.

Exterior	Brown and wrinkled, or grey and speckled, with adherent lichens, with or without (usually with) numerous transverse or branching cracks. Periderm not easily peeled off.	Quills, with a few large, longitudinal cracks. Flat bark, brown, marked by broad, shallow, irregular, longitudinal depressions (digital furrows), with lichens not loose. The periderm readily peels off. Ledger bark has more numerous but less easily seen longitudinal depressions than Calisaya bark, but in other respects is more or less identical.	More or less rough, from longitudinal furrows or ridges, or transverse cracks, or annular fissures and warts; and brownish or reddish-brown in colour.	Often silvery and velvety, from pubescent periderm; corky, and easily indented with the nail; no furrows. Red Carthagena has small pits or shot-like depressions.
Powder	Pale yellow; highly bitter; very astringent.	Cinnamon brown; somewhat aromatic; persistently bitter, also astringent.	Brownish or reddish-brown; no marked odour; taste bitter and somewhat astringent.	Reddish-yellow; not very bitter taste.
Alkaloids	Quinine (2 to 3 per cent.) cinchonine, quinidine, and cinchonidine.	Chiefly quinine (3 to 5 per cent. or up to 10 per cent.), with very little cinchonine and quinidine.	Chiefly cinchonidine (2 to 3 per cent.), with quinine (1 to 3 per cent.), little or no quinidine, and cinchonine and amorphous alkaloid (2 to 4 per cent.).	Quinine, quinidine, and cinchonine.
Imported	In serons or boxes, *ex* Payta, also from India.	Mainly from Java ..	In bales	In serons or boxes, *ex* Carthagena.

Note. *Renewed bark* (see above) is more uniform in appearance and has a less markedly pitted and ridged exterior than the first growth products.

salt, crystalline or amorphous, soluble in water, almost insoluble in ether, yielding *quinone* by oxidation; *quinovin* (*kinovin*, *chinovin*, *kinovic-bitter*), a glucoside, white, uncrystallizable, bitter, almost insoluble in water, soluble in ether and alcohol; volatile oil; fat, greenish, saponifiable by alkalies; *cinchofulvic acid* (*cinchona-red*), an insoluble red colouring matter, most abundant in red bark and resulting from the oxidation of *cincho-tannic acid* (*cinchotannin*), a glucosidal tannin. *Chinoidine* or *quinoidine* is a term applied to the resinous substances, consisting not only of natural amorphous alkaloids, but those which are produced artifically, through the action of heat and acids upon the crystalline alkaloids.

A simple recognition test for Cinchona barks generally, is to moisten the fine powder with a little acetic acid, and heat strongly in a test tube, when vapours are evolved which condense as blood-red drops on the side. Hesse modifies this thus:—Extract the alkaloids with acidulated water and evaporate the liquid with the powdered bark and heat as before.

For the B.P. official assay process see under Cinchonæ Rubræ Cortex.

Uses, etc.—As tonic and antiperiodic, much used in fevers, etc.

THE OFFICIAL CINCHONA ALKALOIDS.

Quininæ Sulphas P.B. $[(C_{20}H_{24}N_2O_2)_2\ H_2SO_4]_2 \cdot 15H_2O$, is the sulphate of an alkaloid prepared from the powder of various kinds of cinchona and remijia barks by extraction with petroleum after the addition of lime, or by the action of an alkali on an acidulated aqueous infusion with subsequent neutralization of the precipitated alkaloid by sulphuric acid and purification of the resulting salt. The freshly prepared salt contains 15·2 per cent. of removable water.

B.P. Characters and Tests.—Filiform silky white crystals, of an intensely bitter taste. Soluble in about 800 parts of *water*, giving a solution which has a bluish fluorescence. Easily soluble in *water* acidulated with a mineral acid. Aqueous solutions of quinine salts yield with *solution of ammonia* white precipitates, soluble in *ether* and in excess of the *solution of ammonia*. When such aqueous solutions are treated first with *solution of bromine* or *of chlorine* and afterwards with *solution of ammonia*, they become of an emerald-green colour, changing to red when mineral acids are added. Exposed to dry air, Quinine Sulphate effloresces until the 15 molecules of water have been reduced to 4. It affords the reactions characteristic of sulphates, 2·5 grammes of the freshly prepared salt should lose 0·38 gramme of water by drying at 212° F. (100° C.). Heated to redness with free access of air, it burns without leaving any residue (absence of mineral impurity).

Quinine Sulphate when tested by the official methods should not afford any appreciable reaction characteristic of cinchonine, quinidine, cupreine, or amorphous alkaloid, and should not yield more than a total of 3 per cent. of crystals of impure cinchonidine.

Dose.—1 to 10 grains.

B.P. Preparations.

Ferri et Quininæ Citras - -	containing 15 per cent. alkaloid (anhydrous).
Pilula Quininæ Sulphatis - - - - -	1 in $1\frac{3}{4}$, about.
Syrupus Ferri Phosphatis c. Quinina et Strychnina,	containing $\frac{1}{5}$ grain in one fluid drachm.
Tinctura Quininæ Ammoniata - - - -	1 in 50.

Quininæ Hydrochloridum P.B., $C_{20}H_{24}N_2O_2,HCl,2H_2O$, is obtained from the same source and by the same process as sulphate of quinine (*see* above), the separated alkaloid being neutralized by hydrochloric acid.

B.P. Characters and Tests.—In crystals resembling those of Quinine Sulphate, but generally somewhat larger. It is soluble in about 35 parts of cold *water*, in 3 parts of cold *alcohol* (90 per cent.), and very soluble in boiling *water* and *alcohol* (90 per cent.). It affords the reactions characteristic of hydrochlorides. It should yield only the slightest characteristic reactions with the tests for sulphates. When converted into quinine sulphate, by dissolving it together with an equal weight of *sodium sulphate* in ten times its weight of hot *water*, and setting the mixture aside at 60° F. (15·5° C.), it should respond to the characters and tests that are mentioned under 'Quininæ Sulphas.' Dried at a temperature of 212° F. (100° C.), it loses 9 per cent. of water. *Dose.*—1 to 10 grains.

B.P. Preparations.

Tinctura Quininæ - - - -	1 in 50 of Tincture of Orange.
Vinum ,, - - - -	1 in $437\frac{1}{2}$ of Orange Wine.

Quininæ Hydrochloridum Acidum P.B., $C_{20}H_{24}N_2O_2,2HCl,3H_2O$.

B.P. Characters and Tests.—A white crystalline powder soluble in less than its own weight of *water*, yielding a somewhat acid liquid. It affords the reactions characteristic of hydrochlorides. It should yield only the slightest characteristic reactions with the tests for sulphates. Each gramme, when dissolved in 20 cubic centimetres of *water*, should require for its complete neutralisation not more than 2·5 cubic centimetres of *volumetric solution of soda*. When converted into quinine sulphate, by dissolving it together with an equal weight of *sodium sulphate* in ten times its weight of hot *water*, exactly neutralising this liquid with *solution of ammonia*, and setting it aside at 60° F. (15·5° C.) to cool, it should respond to the characters and tests which are mentioned under 'Quininæ Sulphas.' Dried at a temperature of 212° F. (100° C.), it loses not more than 12 per cent. of water. *Dose.*—1 to 10 grains.

Non-official Cinchona Alkaloids.—Cinchoninæ Sulphas P.B., 1885 $(C_{19}H_{22}N_2O)_2H_2SO_4,2H_2O$, is the sulphate of an alkaloid obtained from the bark of various species of cinchona and remijia. It may be obtained from the mother liquors of the crystallisation of the sulphates of quinine, cinchonidine, and quinidine by precipitating the alkaloid with caustic soda, washing it with spirit till free from other alkaloids, dissolving in sulphuric acid, and, after purifying the solution with animal charcoal, allowing to crystallise.

Cinchonidinæ Sulphas P.B., 1885 $(C_{19}H_{22}N_2O)_2\ H_2SO_4,3H_2O$, is the sulphate of an alkaloid obtained from the bark of various species of cinchona. It may be obtained from the mother liquors of the crystallisation of sulphate of quinine by further concentration, purified by crystallisation from alcohol, and finally from hot water.

Note. Quinine (*Quinina*), $C_{20}H_{24}N_2O_2,3H_2O$, the basic substance, occurs as trihydrate, and may be precipitated from its salts by alkalies. It is almost insoluble in water, freely so in rectified spirit, chloroform, and ether. Besides the official salts of quinine there are many others made use of in medicine, amongst which the following may be mentioned:—Quinine acid sulphate $(C_{20}H_{24}N_2O_2,H_2SO_4,7H_2O$, obtained by adding dilute sulphuric acid to the sulphate), quinine carbolate, citrate, hydrobromide, phosphate, salicylate, valerianate, tartrate, etc.

CINCHONÆ RUBRÆ CORTEX.—Red Cinchona Bark.—The dried bark of the stem and branches of cultivated plants of Cinchona succirubra, *Pavon* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 142].

N.O.—Rubiaceæ.

Habitat.—S. America; cultivated in India, Ceylon, and Java.

B.P. Characters and Tests.—Imported in quilled or more or less incurved pieces, coated with the periderm, and varying in length from two inches to a foot (five to thirty centimetres) or more—the bark itself from about one-tenth to a quarter of an inch (two and a half to six millimetres) thick, or rarely more; outer surface brownish or reddish-brown in colour, more or less rough from longitudinal ridges which are most apparent in the branch bark, with numerous warts often running into lines in the larger pieces; in some varieties marked with numerous transverse cracks which have not thickened edges; inner surface brick-red or deep reddish-brown, irregularly and coarsely striated; fracture shortly fibrous in the smaller, and finely fibrous in the larger, pieces; powder brownish or reddish-brown; no marked odour; taste bitter and somewhat astringent.

When used for purposes other than that of obtaining the alkaloids or their salts, it should yield between 5 and 6 per cent. of total alkaloids, of which not less than half should consist of quinine and cinchonidine, as estimated by the following methods:—

Mix 20 grammes of Red Cinchona Bark, in No. 60 powder, with 6 grammes of *calcium hydroxide*; slightly moisten the powders with 20 cubic centimetres of *water*; mix the whole intimately in a small porcelain dish or mortar; allow the mixture to stand for an hour or two, when it will present the characters of a moist dark brown powder, in which there should be no lumps or visible white particles. Transfer this powder to a suitable flask fitted with a small reflux condenser, add 130 cubic centimetres of *benzolated amylic alcohol*, boil them together for about half an hour, decant the liquid on to a filter, leaving the powder in the flask; add more of the *benzolated amylic alcohol* to the powder, and boil and decant as before; repeat this operation a third time; then turn the contents of the flask on to the filter, and wash by percolation with more of the *benzolated amylic alcohol* until the Bark is exhausted. Introduce the collected filtrate, while still warm, into a stoppered glass separator; add to it 2 cubic centimetres of *diluted hydrochloric acid*, mixed with 12 cubic centimetres of *water*; shake them well together, and when the acid liquid has separated this may be drawn off, and the process repeated with *water* slightly acidulated with *hydrochloric acid*,

until the whole of the alkaloids have been removed. The liquid should then, while warm, be carefully and exactly neutralised with *solution of ammonia*, and concentrated to the bulk of 16 cubic centimetres. If now about 1·5 grammes of *sodium potassium tartrate*, dissolved in twice its weight of *water*, be added to the solution, and the mixture stirred with a glass rod, insoluble tartrates of quinine and cinchonidine will separate completely in about an hour, and these collected on a filter, washed, and dried in a water-oven, will contain eight-tenths of their weight of the alkaloids, quinine and cinchonidine, which, multiplied by 5, gives the weight of those alkaloids present in 100 grammes of the bark. To the mother-liquor from the preceding process add *solution of ammonia* in slight excess. Collect, wash, and dry the precipitate, which will contain the other alkaloids. The weight of this precipitate, multiplied by 5, and added to the percentage weight of the quinine and cinchonidine, gives the percentage weight of total alkaloids.

Chemistry.—Good quality bark should come up to the official standard, viz., should contain from 5 to 6 per cent. of alkaloid. The proportion of *cinchonidine* is usually larger than that of *quinine*, being from 3 to 4 per cent.

Uses, etc.—As stomachic and tonic, etc.

B.P. Preparations.

Extractum Cinchonæ Liquidum - 1 part in 1, about, containing 5 per cent. total alkaloids.

Infusum Cinchonæ Acidum - - 1 part in 20.

*Tinctura Cinchonæ, 1 part in 5, about, of 70 per cent. alcohol, containing 1 per cent. total alkaloids.

**Used in the preparation of*

Tinctura Cinchonæ Composita, containing 0·5 per cent. alkaloids.

B.P.C. Preparations.—Glycerinum Cinchonæ, Mistura Cinchonæ Acida; *from the yellow bark*, Tinctura Cinchonæ flavæ, Elixir Cinchonæ, Vinum Cinchonæ, Vinum Cinchonæ ferratum.

Note.—The U.S.P. recognises the barks of C. Ledgeriana, C. Calisaya, and C. officinalis, in addition to that of C. succirubra.

REMIJIÆ CORTEX.—Cuprea Bark.—The bark of Remijia Purdieana, *Wedd.*, and Remijia pedunculata, *Trin.*

N.O.—Rubiaceæ.

Habitat.—Southern and Central Columbia.

Characters.—In pieces varying from half an inch to three to four inches in length; from one-quarter to one-twelfth of an inch in thickness, strong and hard, varying from a yellowish to a yellowish-cinnamon colour, and having a somewhat cupreous tint, distinctly curled, very smooth on the inner surface, on the outer surface smoothish, or, in larger pieces, rough, with the epidermis usually adherent, marked, except in the very large pieces, with fine wrinkles and sometimes with transverse or spiral grooves,

which are sometimes quite shallow, but often are deeply and sharply cut. Texture dense and hard; fracture short, not fibrous, and free from spicules.

Chemistry.—Some varieties yield quinine, others only traces, and cinchonidine is generally absent. The alkaloid, *cinchonamine* (0·2 per cent) was discovered in 1881, by Arnaud, in Remijia Purdieana, and has been employed in the chemical laboratory as a test for nitrates. In some varieties *homoquinine* (0·3 per cent.) is present, it is a compound of quinine and *cupreine*. Homoquinine shows fluorescence, and the thalleioquin reaction like quinine. Cupreine is not fluorescent, and is soluble in sodium hydrate solution, but is precipitated by ammonium hydrate. It is also soluble in ether.

Uses, etc.—As a source of the alkaloids which it contains.

ALSTONIA.—**Alstonia.**—The bark of (1) Alstonia constricta, *Mueller* (Bitter Bark), or of (2) Alstonia scholaris, *R. Brown* (Dita Bark).

N.O.—Apocynaceæ.

Habitat.—(1) New South Wales and Queensland, (2) India.

Characters.—The bark of *Alstonia constricta* occurs in pieces from one and a quarter to two inches thick, deeply furrowed, externally brown grey, or after abrasion, ochrey-yellow, and ridged upon the inner surface; the bast layer about one quarter of an inch broad, yellow, tough, fibrous, and covered by the thick, spongy and friable corky layer which is composed of alternating bands of lighter and darker ochre-colour; powder greyish-yellow; odour slight; taste persistently bitter. The bark of *A. scholaris* occurs in thick, irregular, more or less contorted pieces, easily broken. It consists of a rough, greyish epidermis, investing a buff or pale cinnamon-coloured bark; internally still lighter in colour, and of a spongy texture, having a very bitter taste, but devoid of odour.

Chemistry.—The bark of Alstonia constricta contains the alkaloids, *alstonine* (*chlorogenine*, $C_{21}H_{20}N_2O_4$), *porphyrine* ($C_{21}H_{23}N_3O_2$), *alstonidine*, with traces of others. Alstonia bark from A. scholaris, contains three alkaloids, viz., *ditaine* (*echitamine*), *ditamine* and *echitenine*, and several fatty and resinous substances have also been named and described.

Uses, etc.—As febrifuge, etc., said to have similar properties to cinchona bark.

Note.—Alstonia Bark is official in the Indian and Colonial Addendum, A. scholaris for use in India, etc., A. constricta for use in Australasia, the same formulary includes a tincture and infusion. *Poele bark*, from A. SPECTABILIS (*Hab.*—Java), contains the same alkaloids as dita bark, and in addition a crystalline alkaloid, *alstonamine*.

ASPIDOSPERMA.—**Quebracho.**—The bark of the tree Aspidosperma Quebracho blanco, *Schlecht.*

N.O.—Apocynaceæ.

Habitat.—Chili and Argentine.

Characters.—Large pieces, half to three-quarters of an inch thick, covered on the outside with a very thick and rough corky layer of a greyish-brown colour, and deeply divided by furrows and excavations. The inner bark is greyish or yellowish, smooth or somewhat fibrous, often with small black spots; taste intensely bitter, but without much odour.

Chemistry.—Six alkaloids have been described, viz.:—*Aspidospermine*, *aspidospermatine*, *aspidosamine*, *quebrachine*, *hypoquebrachine* and *quebrachamine*. Of these quebrachine is the most active.

Uses, etc.—Tonic, febrifuge and anti-asthmatic. *Dose.*—15 to 60 grains.

CONDURANGO CORTEX.—Condurango Bark.—The sun-dried bark of Gonolobus Condurango, *Triana*.

N.O.—Asclepiadaceæ.

Syn.—Condurango blanco.

Habitat.—Ecuador.

Characters.—In quills or curved pieces; bark about $\frac{1}{8}$th of an inch thick, externally brownish-grey, wrinkled and warty; inner surface pale-brownish and striate; fracture granular, slightly fibrous, brown, with wavy bast wedges and brownish-yellow groups of sclerenchymatous cells; the parenchymatous layer contains starch and raphides; nearly inodorous; taste somewhat bitter and acrid.

Chemistry.—Tannin, extractive matter, resins and *condurangin*. Condurangin, formerly described as a glucoside, is now said to consist of a mixture of two principles.

Uses, etc.—Introduced as a specific for cancer. *Dose.*—10 to 30 grains.

The *B.P.C.* includes a fluid extract and wine.

Note.—*Guayaquil* and *Mexican Condurangos* are derived from species not described.

CALOTROPIS CORTEX.—Mudar Bark.—The dried root-bark of Calotropis procera, *R. Brown*, and of Calotropis gigantea, *R. Brown*.

N.O.—Asclepiadaceæ.

Habitat.—India and Ceylon.

Characters.—It occurs in small, flat or arched pieces, brownish externally, of a yellow-greyish colour internally, with a peculiar smell, and a mucilaginous, nauseous, acrid taste.

Chemistry.—Resins, acrid and bitter, a crystalline, colourless substance—*madaralban*; *madarfluavil* and *caoutchouc*.

Uses, etc.—Recommended in leprosy; used in rheumatism, etc.; "an excellent substitute for ipecac. in dysentery." *Dose.*—5 to 10 grains in powder.

Note.—The bark is official in the Indian and Colonial Addendum for the preparation of a tincture.

CINNAMOMI CORTEX.—Cinnamon Bark.—The dried inner bark of shoots from the truncated stocks of Cinnamomum zeylanicum, *Breyn* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 224]. Obtained from cultivated trees. Imported from Ceylon, and distinguished in commerce as Ceylon cinnamon.

N.O.—Lauraceæ.

Syn.—Ceylon cinnamon.

Habitat.—Ceylon.

B.P. Characters.—In closely rolled quills, each about three-eighths of an inch (nine millimetres) in diameter, and containing numerous smaller quills or channelled pieces. It is thin, brittle, splintery, dull light yellowish-brown externally, and marked by little scars or holes and faint shining wavy lines;

darker brown on its outer surface. Odour fragrant; taste warm, sweet, and aromatic.

Note.—The cinnamon trees are pollarded and treated in much the same way as our coppices are treated. The strips, from shoots one and a half to two years old, after removal are allowed to undergo a species of fermentation for about twenty-four hours, and the outer and middle portion of the bark are removed and the liber dried, first in the shade, and afterwards in the sun. *Tellicherry cinnamon* liber bark is more fibrous, and of an inferior nature.

Chemistry.—Volatile oil, the essential constituent (½ to 1 per cent.) *see* Oleum Cinnamomi; sugar, mannite, starch, mucilage and tannic acid, with about 5 per cent. ash, consisting mainly of potassium and calcium carbonates. The starch is but feebly indicated by tincture of iodine, unless the latter be added in excess, the iodine being absorbed by the essential oil.

Uses, etc.—As stomachic, carminative, and mild astringent. *Dose.*—10 to 20 grains in powder.

B.P. Preparations.

*Aqua Cinnamomi	1 part in 10.
Decoctum Hæmatoxyli	1 ,, 125.
†Oleum Cinnamomi.	
Pulvis Catechu Compositus	1 part in 10.
‡ ,, Cinnamomi Compositus	1 ,, 3.
,, Cretæ Aromaticus	1 ,, 11, about.
,, Kino Compositus	1 ,, 5.
Tinctura Cardamomi Composita	1 ,, 10.
,, Catechu	1 ,, 20.
,, Cinnamomi	1 ,, 5 of alcohol (70 per cent.)
,, Lavandulæ Composita	1 part in 116, nearly.

**Occurs in the composition of*

Mistura Cretæ, Mistura Guaiaci, Mistura Olei Ricini, Mistura Spiritus Vini Gallici, Syrupus Aromaticus, and Syrupus Cascaræ Aromaticus.

†Used in preparing

Spiritus Cinnamomi . . 1 part in 10.

‡Contained in

Pilula Aloes et Ferri.
,, Cambogiæ Composita.

B.P.C. Preparations.—Tinctura Cinnamomi Comp., Tinctura Opii Crocata, etc.

Note.—Saigon Cinnamon is the product of an undetermined species of Cinnamon and more nearly resembles Cassia (*q.v.*). It, together with the Ceylon variety, is official in the U.S.P.

CASSIÆ CORTEX.—Cassia Bark.—The dried bark of Cinnamomum Cassia, *Blume.*

N.O.—Lauraceæ.

Syn.—Chinese Cinnamon.

Habitat.—India and China.

Characters.—(1) *Cassia Cinnamon.*—In quills of various lengths and about one-twenty-fifth of an inch or more in thickness; nearly deprived of the

corky layer; yellowish-brown; outer surface somewhat rough; fracture nearly smooth; odour fragrant, but less delicate than that of Cinnamon; taste sweet and warmly aromatic. (2) *Saigon Cinnamon.*—In quills about six inches long, and one-half to three-fifths of an inch in diameter; the bark about one-tenth of an inch thick; outer surface grey or light greyish-brown with whitish patches, more or less rough from numerous warts and some transverse ridges and fine longitudinal wrinkles, the inner surface cinnamon-brown or dark-brown, granular and slightly striate; fracture short, granular in the outer layer, cinnamon coloured, having near the cork numerous whitish striæ, forming an almost uninterrupted line; odour fragrant; taste sweet, warmly aromatic, somewhat astringent.

Chemistry.—Similar to Ceylon Cinnamon, but containing more starch and mucilage, volatile oil 1 to 2 per cent.

Oleum Cassiæ (*Chinese Cinnamon Oil*) is official in the U.S. under the title Oleum Cinnamomi and in some other Pharmacopœias. It is heavier than cinnamon oil, having S.G. 1·05 to 1·07, and it also differs from the latter in that it should contain at least 75 per cent. of Cinnamic Aldehyde and no Eugenol, consequently, it gives no green or blue colour with ferric chloride.

Note.—Cassia lignea is a term applied to several Cassia barks, amongst others to those of C. cassia, C. burmanni, C. tamala. The barks of C. iners, C. obtusifolium, C. lourieri, C. culilawan, C. sintok, C. incerta are also found in commerce.

Cassia vera in this country is the bark of C. burmanni and C. tamala. *Massoy bark* (the source of oil of Massoy) is obtained from Massora aromatica. *Cassia buds* consist of the immature fruits of one or more species of cinnamon. In appearance they somewhat resemble cloves.

NECTANDRÆ CORTEX.—Bebeeru Bark.

—The dried bark of Nectandra Rodiæi, *Hook.*

N.O.—Lauraceæ.

Syn.—Greenheart Bark.

Habitat.—British Guiana.

Characters.—In flattish heavy pieces, from one to two feet long, two to six inches broad, and a quarter of an inch or more thick. Externally greyish-brown, internally dark cinnamon-brown, and with evident longitudinal striæ. It is very hard and brittle, and its fractured surface presents a coarse grained appearance. Inodorous, but with a strong bitter, astringent taste.

Chemistry.—The amorphous alkaloids, *beberine* ($C_{18}H_{21}NO_3$) and *sipirine; beberic acid*, tannin, gum, resin, etc. Beberine is an amorphous alkaloid, at one time regarded as being identical with *buxine* (from Buxus sempervirens) and *pelosine* (from Cissampelos Pareira). It is pale yellow, resinous in appearance, soluble in ether, and forms uncrystallisable salts with acids. Sipirine is also amorphous, but is insoluble in ether.

Uses, etc.—As tonic and antiperiodic. *Dose.*—30 to 60 grains; rarely given except in the form of alkaloid.

Beberinæ Sulphas, formerly official, was described by the Pharmacopœia as a mixture of the sulphates of beberine, nectandrine, and other alkaloids. It was ordered to be prepared by exhausting the bark with sulphuric acid, precipitating the acid solution with alkali, dissolving the precipitated bases in sulphuric acid, evaporating the solution, painting on glass and drying. The compound thus obtained is in dark-brown, thin, translucent scales, yellow in powder, and having a bitter taste; it consists of about 60 per cent. of alkaloids, one half of which is beberine, the remainder being other amorphous alkaloids.

COTO CORTEX.—Coto Bark.—A dried bark of unknown origin.

N.O.—Lauraceæ (probably) or Monimiacæ.

Habitat.—Bolivia.

Characters.—Flat or curved, deprived of cork, one-fourth to one-half inch thick; outer surface cinnamon brown, smooth; inner surface darker brown; fracture granular and short in outer layer, fibrous and tough in the inner; odour aromatic, cinnamon-like; taste pungent, bitterish. An alcoholic dry extract is said to give a red colouration with nitric acid. Para-Coto bark is very similar in appearance, though less pungent in odour and taste, but is not readily distinguishable from true Coto except by a comparison of chemical constituents.

Chemistry.—*Cotoin*, $C_{14}H_{12}O_4$ (pale-yellow crystalline glucoside, soluble in alcohol, blood-red with nitric acid), *piperonylic* (*methylene proto-catechuic*) *acid*, soft and hard resins, starch, gum, tannin, etc. Para-Coto bark contains *paracotoin* $C_{19}H_{12}O_6$, *leucotin*, *hydrocotin*, etc. Paracotoin gives a yellow (not red) colour with nitric acid.

Uses, etc.—Recommended in diarrhœa, etc *Dose.*—5 to 10 grains in powder or tincture (B.P.C., 1 in 10 of alcohol). Cotoin and paracotoin are also given in doses of 1 to 3 grains.

MEZEREI CORTEX.—Mezereon Bark.—The dried bark of Daphne Mezereum, *Linn.*, or of Daphne Laureola, *Linn.*, or of Daphne Gnidium, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plates 225, 226, 227].

N.O.—Thymelaceæ.

Habitat.—Britain and Europe.

B.P. Characters.—In long, thin, more or less flattened strips, or in quills of various lengths; flexible, very tough and fibrous. The outer surface varies in colour from olive-brown or reddish-brown to deep purplish-brown; the inner surface is nearly white, and silky. The transverse section exhibits numerous groups of bast fibres in the secondary bast. The bark readily separates into two layers. It has no marked odour, but an acrid burning taste.

Note.—The bark of the root is said to be more active than that of the stems. The stem bark has scars, and when fresh the green mesophlœum may be seen, which distinguishes it from root bark. The bark of the spurge laurel has more of a grey tint than that of Mezereon. The flowers of Daphne Mezereum appear before the leaves, and are of a rose colour; those of Daphne Laureola are of a yellowish-green. The bark of the *spurge-flax* (D. Gnidium) is very similar to the above, and has the same acrid properties.

Chemistry.—The important constituents are a soft acrid resin (*mezerein*), with vesicant properties, and a glucoside *daphnin*, which, by the action of dilute acids, is resolved into *daphnetin* (dioxycoumarin) and sugar.

Uses, etc.—Rarely given internally; externally stimulant and vesicant.

B.P. Preparation.

Liquor Sarsæ Compositus Concentratus - 1 part in 20.

Note.—An ointment prepared from an extract is official in several of the Continental Pharmacopœias. The U.S.P. has a fluid extract. An ethereal extract of Mezereon was official in the 1885 Pharmacopœia and is retained in the B.P.C.

CASCARILLA.—Cascarilla.—The dried bark of Croton Eluteria, *J. J. Bennett* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 238].

N.O.—Euphorbiaceæ.

Habitat.—Bahama Isles.

B.P. Characters.—In quills, from one to three inches (two and a half to seven and a half centimetres) or more in length, and from about one-sixth to half an inch (four to twelve millimetres) in diameter, or in small curved pieces. The outer layer consists of a dull-brown or dark-grey longitudinally wrinkled cork, frequently marked with small longitudinal and transverse cracks, and more or less completely covered with silvery-grey patches spotted with minute black dots; it easily separates, disclosing a brown or dark-grey inner layer marked with longitudinal and transverse furrows. Fracture short, and resinous; the transverse section exhibits under a lens dark reddish-brown bast traversed by thin whitish medullary rays, but no groups of sclerenchymatous cells. It has an agreeable aromatic odour, especially when burned, and an aromatic taste.

Chemistry.—Volatile oil $2\frac{1}{2}$ to 3 per cent. (consisting of a terpene and oxygenated portion), resin, tannic acid, etc., and *cascarillin*. Cascarillin ($C_{16}H_{24}O_5$) is white, crystalline, inodorous, bitter; soluble in alcohol, ether and hot water, and has not been classed chemically.

Uses, etc.—Aromatic and tonic. *Dose.*—15 to 30 grains.

B.P. Preparations.

Infusum Cascarillæ - 1 part in 20.
Tinctura ,, - 1 ,, 5 of alcohol (70 per cent).

B.P.C. Preparations.—Infusum Cascarillæ Concentratum, Mistura Cascarillæ Comp.

Note.—Barks of other species of Croton are occasionally met with in commerce.

Malambo bark (Croton Malambo, from Venezuela) is in quills one-half to one inch in diameter, and six to eight inches long. It has a thin, soft, whitish, easily-removed cork; the inner surface is grey-brown, finely striate; fracture short, splintery; odour and taste aromatic and bitter. Composition similar to that of Cascarilla.

Copalchi bark (Croton Pseudochina, from Mexico) is much like the preceding; it is about one-fifth of an inch thick, hard, dense, with a greyish or yellowish corky layer, and beneath this it is transversely fissured; bast is reddish-brown, coarsely striated, and breaks with a short, irregular fracture. Composition similar to that of Cascarilla.

A bark supposed to be that of Croton lucidus has been found occasionally mixed with Cascarilla bark. Its periderm does not peel off readily, and is of a fawn colour. Its inner surface is of a reddish tint, and it is furnished with a number of straight, closely packed, raised lines. The taste is not aromatic, but astringent, and almost without bitterness. Its tincture is not precipitated by water.

The species Croton Cascarilla grows in the Bahamas, and formerly yielded much of the Cascarilla bark of commerce.

ULMUS FULVA.—Slippery Elm.—The inner bark of Ulmus fulva, *Michaux.*

N.O.—Urticaceæ.

Syn.—Red Elm.

Habitat.—United States of America.

Characters.—In flat pieces varying in length and width, about one-eighth of an inch thick, tough, pale brownish-white, the inner surface finely ridged; fracture fibrous and mealy; the transverse section delicately chequered. Odour slight, peculiar (not unlike Fenugreek); taste mucilaginous, insipid. Powder greyish, fawn-coloured.

Chemistry.—Abounds in mucilage, which is precipitated by solutions of acetate and subacetate of lead, but not by alcohol; it is similar to the mucilage contained in linseed.

Uses, etc.—For demulcent poultices and draughts (Mucilago Ulmi Fulvæ B.P.C.) also as a nutrient.

Note.—Slippery Elm is official in the United States. It has been found in a powdered form largely adulterated with wheat flour.

ULMI CORTEX.—Elm Bark.—The dried inner (liber) bark of Ulmus campestris, *Linn.*, broad-leaved elm.

N.O.—Urticaceæ.

Habitat.—Britain.

Characters.—A tough, brownish-yellow bark, about one-fifth of an inch thick, without smell; taste mucilaginous, slightly bitter and astringent. Its decoction is turned green by perchloride of iron, and precipitates with a solution of gelatine.

Chemistry.—Tannic acid (3 per cent.) gum and mucilage (20 per cent.), and a little resin.

Uses, etc.—As demulcent and emollient, formerly included in the B.P. for the production of a decoction, retained in the B.P.C.

JUGLANS.—Juglans.—The bark of the root of Juglans cinerea, *Linn.*

N.O.—Juglandaceæ.

Syn.—Butternut.

Characters.—In quills or curved (rarely flat) pieces, about one-fifth of an inch thick; the outer surface dark-grey and nearly smooth, or deprived of the soft cork and dark-brown; the inner surface smooth and striate, or stringy from adhering inner bark; transverse fracture short, delicately chequered, whitish and brown; odour feeble; taste bitter and somewhat acrid.

Chemistry.—*Nucin* (*juglandic acid, juglone*), which is acid, orange-yellow, crystalline, purple with alkalies, volatile; fixed oil and tannin.

Uses, etc.—As cathartic and tonic. *Dose.*—60 to 120 grains. Formerly official in the U.S. for the production of an extract.

Note.—The kernel of the fruit of the butternut contains much fixed oil, as also does that of the *English walnut* (JUGLANS REGIA).

MYRICÆ CORTEX.—Bayberry Bark.—The bark of Myrica cerifera, *Linn.*, the Wax-myrtle.

N.O.—Myricaceæ.

Habitat.—North America.

Characters.—In quills or curved pieces, about one-sixteenth of an inch in thickness; externally whitish or greyish; scaly; beneath the corky layer smooth red-brown; inner surface red-brown, finely striate; fracture reddish, granular, slightly fibrous; odour somewhat aromatic, taste astringent, bitter, pungently acrid.

Chemistry.—Volatile oil, a red-colouring substance, tannic acid, resins, and a peculiar acrid principle, *myricinic acid*, having saponin-like properties.

Uses, etc.—As tonic, astringent; in large doses, emetic. *Dose.*—5 to 10 grains.

QUERCUS CORTEX.—Oak Bark.—The dried bark of the smaller branches and young stems of Quercus robur. *Linn.* Collected in spring, from trees growing in Britain.

N.O.—Cupuliferæ.

Habitat.—Britain.

Characters.—In quills, covered with a smooth, shining, silvery or ash-grey corky layer, variegated with brown patches or with lenticels; internally cinnamon-brown or brownish-red, and longitudinally striated; fracture tough and fibrous; taste very astringent; no marked odour.

Chemistry.—*Quercitannic acid* (10 to 20 per cent.) $C_{17}H_{16}O_9$ is the important constituent. By hydrolysis it is converted into the phlobaphene *oak red* ($C_{28}H_{22}O_{11}$). Younger barks contain the largest amount of tannin. *Quercite* or oak sugar is also present.

Uses, etc.—As astringent; formerly official. The B.P.C. includes a decoction.

Allied Species.—QUERCUS ALBA (white oak), official in the U.S., occurs in nearly flat pieces, deprived of the corky layer, about a quarter of an inch thick, pale brown; inner surface with short, sharp, longitudinal ridges; tough, of a coarse, fibrous fracture, a faint tan-like odour, and a strongly astringent taste. As met with in shops it is usually in an irregular, coarse fibrous powder, which does not tinge the saliva yellow. In constitution this bark is similar to the English oak bark.

QUERCUS TINCTORIA (black oak).—The bark of this species is imported from America in large quantities under the name of *quercitron* and is used for dyeing. The colouring principle, *quercitrin*, $C_{36}H_{38}O_{20}$ (which in addition to querci-tannic acid it contains), is a glucoside resolvable into *quercetin* and a sugar.

QUERCUS ÆGILOPS.—The acorn cups of this tree are used, under the name of *valonia*, as a tanning material.

QUERCUS SUBER (cork oak).—The much developed epiphlæum or corky layer of the bark constitutes the cork of commerce; when taken from the younger branches of the tree is used by tanners, under the name of European *alcornoque* bark. The inner bark of older stems is also imported for tanning purposes, under the name of cork-tree bark.

Other species of which the barks come into commerce are Q. FALCATA (*Spanish oak*), Q. PRINUS (*white chestnut oak*) and Q. MONTANA (*rock chestnut oak*). Indian oak barks have been shown to contain tannins similar to those of the European species.

Note.—Mangrove Bark, the bark of Rhizophora Mangle (*N.O.*—Rhizophoraceæ. *Hab.*—India, etc.) has been used in medicine, it is highly astringent and finds employment as a tanning material.

SALIX.—Willow.—The bark of Salix alba, *Linn.*, and of other species of Salix.

N.O.—Salicaceæ.

Habitat.—Britain, etc.

Characters.—In fragments or quills, from one-twenty-fifth to one-twelfth of an inch thick, smooth; outer surface somewhat glossy, brownish or yellowish, more or less finely warty, under the corky layer green; inner surface brownish-white, smooth, the liber separating in thin layers; inodorous, bitter, and astringent.

Chemistry.—Tannin, resin, fat, gum, etc., and *salicin* (see below).

Uses, etc.—As source of salicin.

Salicinum P.B., Salicin, $C_6H_{11}O_5.O.C_6H_4CH_2OH$ (obtainable also from Poplar bark), is a crystalline glucoside obtained by treating the bark with hot water, removing tannin and colouring matter from the decoction by means of lead oxide or subacetate, removing excess of lead, evaporating, purifying and crystallising. It is obtainable in white, shining, slender crystals, inodorous, but very bitter, soluble in twenty-eight parts of cold water, in one of boiling water, soluble in alcohol, insoluble in ether and oil of turpentine. With concentrated sulphuric acid it gives a red colour, and when heated with potassium bichromate and sulphuric acid, the odour of oil of meadow-sweet is produced, due to the formation of salicylic aldehyde. By the action of dilute acids salicin is broken up into grape sugar and *saligenin* (ortho-oxybenzyl alcohol), which latter, by further boiling, yields the alcohol of which it is the glucoside, viz., *saliretin*. Nitric acid breaks it up into *helicin* and *helicoidin*.

Note.—Salicin is usually prepared from the barks of S. fragilis (Rood scorce) and S. purpurea, which yield about 3 per cent. of Salicin. Black Willow Bark (from S. nigra or S. discolor) has been used to a considerable extent in medicine as a sedative; the B.P.C. includes a liquid extract. This bark contains no Salicin but *Salinigrin* ($C_{13}H_8O_7$) a glucoside yielding on hydrolysis glucose and meta-oxybenzaldehyde.

POPULUS.—Poplar.—The bark of Populus tremulus, *Linn.* (Aspen) and other species.

N.O.—Salicaceæ.

Habitat.—Britain, etc.

Characters, Chemistry, etc.—The bark contains salicin, and, in addition, a substance named *populin*, $C_{20}H_{22}O_8$ which in appearance and properties much resembles salicin, and chemically consists of salicin and benzoic acid combined in equivalent proportions, being benzoyl-salicin.

LARICIS CORTEX.—Larch Bark.—The bark of Pinus larix, *Linn.* (Abies larix). Collected in spring, deprived of its outer rough portion and dried.

N.O.—Coniferæ.

Habitat.—Britain.

Characters.—In flattish pieces or quills of various lengths and sizes. The outer surface is dark-red or rosy, and somewhat uneven; inner surface nearly smooth, and yellowish-white or pinkish-red according to its age; fracture close, except the liber which is somewhat fibrous, and the fractured surface, except internally, of a deep carmine-red colour. Odour slightly balsamic and terebinthinous; taste astringent.

Chemistry.—Oleo-resin, gum, starch, sugar and *laricinic acid* (*larixine*); the latter is a volatile, sublimable acid.

Uses, etc.—As astringent and gentle stimulant; formerly official for the preparation of a tincture, retained in the B.P.C.

Note 1.—Terebinthina veneta (Venice or Larch Turpentine) is an oleo-resin obtained by boring in the heart-wood of the larch tree, collecting and filtering. *Characters.*—It is a nearly transparent, or slightly opaque, and somewhat fluorescent, thick liquid of a terebinthinate odour, a bitter and aromatic taste, and a yellowish or greenish-yellow colour. It contains volatile oil (mainly terpenes), neutral and acid resins, and is freely soluble in alcohol, amylic alcohol, acetone, and glacial acetic acid, and does not become hard when mixed with magnesia. A fictitious variety is made by melting together oil of turpentine and resin.

Note 2.—Pinus canadensis [Tsuga canadensis (*N.O.*—Coniferæ)], the Hemlock-Spruce of North America, yields a reddish bark rich in tannin, it has been employed in medicine as an astringent in the form of a liquid extract but finds its chief use as a tanning material. Pinus Strobus, White Pine (*N.O.*—Coniferæ) the Weymouth Pine of North America, yields an astringent bark with reputed expectorant properties.

10.—MISCELLANEOUS DRUGS.

Under this head are included organised drugs such as hair-structures, glands, etc., and those parts of plants such as arils, etc, which are regarded as being more or less abnormal, and do not readily admit of classification.

GOSSYPIUM.—Cotton.—The hairs of the seed of Gossypium barbadense, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 37], and of other species of Gossypium, freed from fatty matter.

N.O.—Malvaceæ.

Syn.—Cotton Wool.

Habitat.—America, India, etc.

B.P. Characters and Tests.—In long white soft filaments, each consisting of an elongated cell, appearing, when seen under the microscope, as a flattened twisted band with slightly thickened rounded edges; inodorous and tasteless. It should readily be wetted by *water*, to which it should not impart either an alkaline or an acid reaction. On incineration in air it burns, leaving less than 1 per cent. of ash. It dissolves in concentrated *solution of copper ammonio-sulphate.*

Note.—The fatty matter is removed from cotton by boiling it under pressure with caustic soda or soda ash, with or without the addition of soap. The whiteness of colour is obtained by treatment with bleaching lime, followed by washing with dilute mineral acid.

Chemistry.—Ordinary cotton-wool ("non-absorbent," "grey") contains about 10 per cent. of fixed oil (*see* Oleum Gossypii). Pure cotton consists essentially of nearly pure cellulose ($C_6H_{10}O_5$), and yields with nitric acid the explosive compounds known under the name of the nitro-celluloses. Dinitrocellulose, the official pyroxylin or gun-cotton, is used in the preparation of collodion, and is readily soluble in 3 parts of ether mixed with 1 part of rectified spirit.

Uses, etc.—For preparing collodion and for making surgical dressings.

B.P. Preparation.

Pyroxylinum, *from which are prepared*

*Collodium	- - - - - -	1 part in 48.
„ Vesicans	- - - -	1 „ 40.

**Used in preparing*

Collodium Flexile.

B.P.C. Preparations.—Various medicated wools.

Note.—Pyroxylin is di-nitrocellulose, $C_6H_8(NO_2)_2O_5$, and is prepared by the action of a mixture of nitric and sulphuric acids on cotton. Gun-cotton (trinitrocellulose), $C_6H_7(NO_2)_3O_5$, is insoluble in alcohol and ether.

Celluloid (*Xylonite*) is a mixture of nitro-cellulose with camphor, the presence of the latter serving to render it capable of being moulded when warm. Celluloid finds large use in the arts as a substitute for bone, ivory, and tortoise-shell, but its use is open to the objection that it is highly inflammable.

ARAROBA.—Araroba.—A substance found in cavities in the trunk of Andira Araroba, *Aguiar.* [*Pharm. Journ.* ser. 3, vol. x. p. 43, plate], freed as much as possible from fragments of wood, dried and powdered.

N.O.—Leguminosæ.

Syn.—Goa Powder; Crude Chrysarobin.

Habitat.—Brazil.

Characters and Test.—The powder varies in colour from brownish-yellow to umber-brown. It should yield to hot *chloroform* not less than 50 per cent. of a substance which, on evaporating the chloroform from the filtrate, and drying and powdering the residue, should have the characters of Chrysarobin.

Chemistry.—*Chrysarobinum* (50 per cent.), resin (2 per cent.) woody fibre (5·5 per cent.), bitter extractive (7 per cent.).

Uses, etc.—For preparing Chrysarobinum.

Chrysarobinum P.B. (Chrysarobin) is a substance obtained from Araroba by extracting with hot chloroform, evaporating to dryness, and powdering. It consists chiefly of a definite chemical substance also known as chrysarobin, but contains a varying proportion of chrysophanic acid. It is a crystalline, yellow, tasteless, inodorous powder, entirely soluble in hot chloroform, almost entirely soluble in hot alcohol (90 per cent.), partially soluble in petroleum spirit, but only slightly soluble in water. In solution of potassium hydroxide it partially dissolves, and assumes a deep brownish-red colour. Heated with free access of air it melts, giving off yellow fumes, and when incinerated does not leave more than 1 per cent. of ash. Chrysarobin has formula $C_{30}H_{26}O_7$, and is regarded as being a reduced quinone. In alkaline solution it takes up oxygen and is converted into chrysophanic acid (dioxymethyl anthraquinone), and when distilled with zinc-dust it yields *methyl-anthracene* ($C_{15}H_{12}$). *Lenirobin* and *eurobin*, the tetra- and tri-acetates respectively of chrysarobin, are recommended as substitutes for the latter.

Uses, etc.—As irritant externally in skin diseases, and given internally in doses of from $\frac{1}{6}$ to $\frac{1}{2}$ grain.

B.P. Preparation.

Unguentum Chrysarobini - - - - 1 of Chrysarobin in 25.

Note.—Chrysarobin is still not uncommonly called chrysophanic acid, for under this name it was first known.

MUCUNA.—Cowhage.—The hairs of the legumes of Mucuna (Dolichos) pruriens, *D.C.*

N.O.—Leguminosæ.

Habitat.—East and West Indies.

Characters.—One-celled, one-twelfth to one-eighth of an inch long, stiff, brown-red, sharply serrate and pointed, thick-walled, partly filled with a brown granular matter. When handled they are intensely irritating to the skin.

Chemistry.—Tannin and resin.

Uses, etc.—As mechanical anthelmintic. *Dose.*—10 to 60 grains mixed with treacle.

INDIGO.—Indigo.—A blue dyestuff obtained from various species of Indigofera, *e.g.*, Indigofera tinctoria, *Linn.*

N.O.—Leguminosæ.

Habitat.—India, and cultivated in sub-tropical countries.

Characters.—In porous, hard, brittle lumps or cubical cakes; inodorous, tasteless, of a deep blue colour, and when rubbed with the finger-nail acquiring a bronze-like hue; insoluble in water, alcohol, ether, dilute acids and alkalies, fixed and volatile oils. When heated to about 290° C. it evolves a reddish-violet vapour which condenses in minute crystals. It dissolves freely in concentrated sulphuric acid, in strong alkaline solutions, and is slightly soluble also in aniline, nitrobenzene, paraffin and chloroform. The ash present amounts to about 7 per cent.

Mode of Preparation.—Indigo does not pre-exist in the plant, but results from fermentation set up when the plant is immersed for a considerable period in water. By this means yellow transparent *indican* ($C_{26}H_{31}NO_{17}$) is formed in solution, and this, when oxidised by agitation with air, throws down indigo as an insoluble sediment (the saccharine body, *indiglucin* $C_6H_{10}O_6$, being formed at the same time). The precipitate is then collected, washed, pressed and dried. The product is about 3 per cent.

Chemistry.—Indigo contains from 50 to 70 per cent. of *indigo-blue* or *indigotin*, $C_{16}H_{10}N_2O_2$ (the important constituent), and, in addition, a varying percentage of *indigo-gluten*, a proteid. When treated with reducing agents, indigo bleaches to *indigo-white*, $C_{16}H_{12}N_2O_2$, which, by oxidation, yields pure indigotin. Indigotin, by further oxidation, yields *isatin* ($C_{16}H_{10}N_2O_4$), and this, when distilled with potash, gives *aniline*.

Uses, etc.—Indigo was formerly used as a specific for epilepsy, but it is of doubtful medicinal value. It is one of the most valuable dye-stuffs known.

Note.—Soluble Indigo, Sulphate of Indigo, is prepared by treating powdered indigo with oil of vitriol. The resulting pasty mass dissolves in water and contains, in solution, *monosulphindigotic acid* (*sulphopurpuric acid*, *indigo-purple*) $C_{16}H_9N_2O_2HSO_3$ and *disulphindigotic acid* $C_{16}H_8N_2O_2(HSO_3)_2$. *Indigo-carmine* is the sodium salt of the latter acid.

Synthetic Indigo.—The rapid advances in the production of artificial Indigo seem likely to have an effect on the indigo-planting industry, comparable to that caused to the madder plantations by the invention of synthetic alizarin. Many processes have been patented and the one used on the largest scale employs napthalene as its starting point.

MACIS.—Mace.—The arillus of the fruit of Myristica fragrans, *Houtt.* (Nutmeg).

N.O.—Myristicaceæ.

Habitat.—Banda Isles.

Characters.—In bands one inch or more long and three-quarters to one inch wide, somewhat branched and lobed above, united to broader bands below; brownish-orange; fatty when scratched or pressed; odour fragrant, taste warm and aromatic. Mace envelopes the hard testa of the seed and is developed from the hilum. After removal it is dried in the sun, or in wet weather by artificial heat.

Chemistry.—Volatile oil, which exudes readily on pressure (7 to 9 per cent. or more); fixed oil, resins, sugar, gum and protein. It contains no starch.

Uses, etc.—As stimulant, tonic; its chief use, however, is as a flavouring agent.

Mace Oil.—True oil of mace differs slightly from nutmeg oil (which is frequently substituted for it). It contains about 50 per cent. of terpene,

together with *myristicol* ($C_{10}H_{16}O$), a phenol, and a crystalline compound having formula $C_{12}H_{14}O_3$, which latter, though sometimes called *myristicin*, must be carefully distinguished from the glyceride of myristic acid.

Substitutions.—*Bombay Mace* from M. malabarica is deep reddish-brown in colour, more segmented and in longer pieces (two and a quarter inches) than the Banda or true Mace. Its powder exhausted with petroleum ether yields 30 per cent. ether soluble matter, Banda Mace giving but 2·5 per cent.

Macassar Mace from M. argentea is dull brownish in appearance, less segmented, with an odour recalling sassafras and an acrid taste.

SASSAFRAS MEDULLA.—Sassafras Pith.—The pith of Sassafras officinale, *Nees and Eberm.*

N.O.—Lauraceæ.

Habitat.—Indigenous to North America.

Characters.—In slender cylindrical pieces, often curved or coiled, light, spongy, white, inodorous, insipid. Macerated in water it forms a mucilaginous liquid which is not precipitated by the addition of alcohol.

Chemistry.—Its principal constituent is mucilage, not precipitated by alcohol or lead acetate.

Uses, etc.—As demulcent, etc. Included in the U.S.P. and B.P.C. for the production of a mucilage.

KAMALA.—Kamala.—A powder which consists of the minute glands and hairs obtained from the surface of the fruits of Mallotus philippinensis, *Muell. Arg.* (Rottlera tinctoria).

N.O.—Euphorbiaceæ.

Syn.—Glandulæ rottleræ.

Habitat.—India.

Characters and Test.—A fine granular mobile powder of a brick-red or madder-colour, and nearly tasteless and inodorous. Water has scarcely any effect on it, even at a boiling temperature, but it forms deep red solutions with alcohol, ether, or chloroform. When examined by the microscope it is seen to consist of irregular spherical flattened or depressed garnet red glands with wavy surfaces, mixed with nearly colourless thick-walled stellate hairs. On ignition in air it should yield 4 or 5, or at most 10 per cent. of ash. The lighter coloured particles present in Kamala are bits of the epicarp, and may be separated from the glands by taking advantage of their lightness, either by a process of winnowing or rolling down an inclined piece of paper. When blown across a flame it ignites with a flash like lycopodium.

Chemistry.—Resin (80 per cent.), *rottlerin* (crystalline, soluble in ether, insoluble in water), *isorottlerin*, tannic acid, gum and volatile oil. The ash should be as given above, but many commercial samples yield very much more, as much as 60 per cent. having been noted, the excessive percentage being due to sand and a ferruginous earth. The resin is said to be the active constituent.

Uses, etc.—As tænicide with purgative action. *Dose.*—30 to 120 grains. A non-official tincture is prepared.

Note.—*Wurrus, Vars* or *Wars* is a kamala imported from Aden; the glands, when viewed with the microscope, are seen to be different from the official powder. It is said to be derived from Flemingia congesta (*N.O.*—Leguminosæ). Rottlera Schimperi yields a bark (*Cortex Musenæ*) which has anthelmintic properties.

LUPULINUM.—Lupulin.—Glands obtained from the strobiles of Humulus Lupulus, *Linn.*

N.O.—Urticaceæ.

Syn.—Lupulinic Glands.

Habitat.—Britain.

B.P. Characters and Tests.—A granular brownish-yellow powder composed of minute glands, each consisting of a single hemispherical layer of cells, the cuticle of which has been raised by the secretion of the oil or oleo-resin contained in the gland. It has a strong hop-like odour and a bitter aromatic taste. It should contain not more than 40 per cent. of matter insoluble in *ether*, and yield not more than 12 per cent. of ash when incinerated.

Chemistry.—See under Lupulus.

Uses, etc.—Aromatic, tonic, sedative, etc. *Dose.*—2 to 5 grains. Included in the U.S.P. for the production of a fluid extract and oleo-resin, the latter which is also contained in the B.P.C. being an acetone preparation.

GALLA.—Galls.—Excrescences on Quercus infectoria, *Olivier* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 249], resulting from the puncture and deposition of an egg or eggs of Cynips Gallæ tinctoriæ *Olivier* [*Steph. and Church. Med. Bot.* plate 152].

N.O.—Cupuliferæ.

Syn.—Nut-galls.

Habitat.—Asia Minor, Persia, etc.

B.P. Characters.—Hard, heavy, subglobular, from half an inch to three-quarters of an inch (twelve to eighteen millimetres) or more in diameter, tuberculated on the surface, the tubercules and intervening spaces being smooth; dark, bluish-green or dark olive-green externally, yellowish or brownish-white within, with a small central cavity. No odour; taste intensely astringent.

Note.—The females of this species of hymenopterous insect pierce the tender branches of this small stunted oak with their ovipositors and deposit one or more eggs. The irritation thus produced causes a flow of the juices of the plant and subsequent formation of a gall around the larva.

Varieties.—Aleppo or Turkey galls are the most esteemed and occur in three varieties:—

(*a*). *Blue galls* (Gallæ Cæruleæ) vary in size, and are gathered before the insect has left its prison.

(*b*). *Green galls*—the same, but greenish, and often larger than the blue.

(*c*). *White galls* are of a light colour, and generally have a small round hole in them through which the insect has made its escape. They are inferior in astringent property and not official.

The following galls also obtain commercial use :—

Mecca galls (from Bassorah), known as Dead Sea apples, and "mala nisana," are spherical in shape and surrounded about the centre by a circle of horned protuberances. Not official.

English galls—spherical, brown, smooth, no protuberances, light in weight, and usually with perforation showing the release of insect. They are less rich in gallo-tannic acid than the Aleppo galls.

Chinese galls –of an irregular shape and very astringent taste. Imported from China, and said to be formed by the puncture of the leaves of Rhus semialata (*N.O.*—Anacardiaceæ) by a species of aphis. Chinese galls contain 70 to 80 per cent. of gallo-tannic acid.

Chemistry.—Gallo-tannic acid (30 to 80 per cent.), *gallic acid* (2 to 4 per cent.), sugar and gum (2·4 per cent.), resin, protein, a little starch, calcium salts (2·4 per cent.) and insoluble matter, chiefly lignin.

Uses, etc.—As powerful astringent. *Dose* (in powder).—10 to 20 grains.

B.P. Preparations.

*Acidum Tannicum.	
Unguentum Gallæ - - - -	1 part in 5.
,, ,, cum Opio - -	1 ,, 5, nearly.
**Used in the preparation of*	
Acidum Gallicum.	
Glycerinum Acidi Tannici - -	1 part in 5.
Suppositoria ,, ,, -	each containing 3 grains.
Trochiscus ,, ,, - ,, ,,	$\frac{1}{2}$ grain.

B.P.C. Preparations.—Decoctum Gallæ, Tinctura Gallæ.

Tannic Acid (Gallo-tannic acid, Tannin), $C_{13}H_9O_7COOH,2H_2O$, is extracted from galls by treatment with a mixture of ether and water, and is obtained in thin, glistening scales or yellow vesicular masses, readily soluble in water and in rectified spirit. It is soluble in 1 part of water or of alcohol (90 per cent.), and slowly in 1 part of glycerin. It is precipitated from its aqueous solution and loses its astringency in the presence of many mineral salts and acids. The aqueous solution precipitates solutions of isinglass, albumen, alkaloids, and tartarated antimony, and gives with test-solution of ferric chloride a bluish-black colour. It should leave no appreciable residue when incinerated with free access of air. It has the constitution of *digallic acid*, and in common with other tannins, yields protocatechuic acid when fused with caustic potash.

Note.—There are in the vegetable kingdom many varieties of tannin, some of which give a green precipitate with ferric chloride, *e.g.*, cinchona-tannic acid, catechu-tannic acid, caffetannic acid, etc.

Gallic Acid, $C_6H_2(OH)_3COOH$, is obtained from galls by treatment with diluted sulphuric acid; the acid has the effect of hydrating the tannic acid. It occurs in acicular prisms or silky needles, readily soluble in boiling water, in rectified spirit, and in glycerin; soluble in 100 parts of cold water, in 5 of alcohol, and 40 of ether. It may be distinguished from tannic acid by not giving a precipitate with gelatine, albumen, alkaloids, or tartarated antimony. It has the constitution of a *trihydroxybenzoic acid*, $C_6H_2(OH)_3COOH,H_2O$, and may be prepared synthetically by treating brom-dioxybenzoic acid with caustic potash.

B. CRYPTOGAMOUS.

These consist of organised vegetable drugs derived from, or themselves being, plants devoid of obvious flowers, including ferns, algæ, fungi, etc. The Cryptogams are usually classified into three groups, Thallophyta, Bryophyta, and Pteridophyta, and the relation to these classes of the commonly used drugs of Cryptogamous origin is shown in the following scheme:—

GROUP—THALLOPHYTA.
- CLASS—ALGÆ. Gracillaria, Fucus, Chondrus, Laminaria.
- CLASS—FUNGI. Cerevisia, Ustilago, Ergota, Agaricus.
- CLASS—LICHENES. Cetraria, Lacmus.

GROUP—BRYOPHTA.
- CLASS—MUSCI. Sphagnum.

GROUP—PTERIDOPHYTA.
- CLASS—FILICINÆ. Filix Mas, Adiantum.
- CLASS—LYCOPINIDÆ. Lycopodium.

GRACILARIA (Fucus Amylaceus).—**Ceylon Moss.**—The dried plant (thallus) of Gracilaria (Plocaria, Sphærococcus) lichenoides *Agardh.*

Sub-class—Rhodophyceæ (Florideæ).

Syn.—Edible Moss.

Habitat.—Coasts of Ceylon and the Islands of Eastern Archipelago.

Characters.—Occurs in yellowish-white or light purple, ramifying filaments, from one to seven inches in length; at the base the larger filaments not exceeding the thickness of a crow-quill, the smaller ramifications being about as thick as fine sewing thread; consistence cartilaginous; odour resembling seaweed; mucilaginous and feebly saline.

Chemistry.—Vegetable jelly, known as pectin or *gelose* (37 to 38 per cent.), protein (7·5 per cent.), ash (10·2 per cent.).

Uses, etc.—As nutritive and demulcent, similar in properties to Irish moss; official in the Indian Pharmacopœia, which includes a decoction.

Note.—Corsican Moss.—This is obtained from about twenty to thirty different species of Algæ, SPHÆROCOCCUS HELMINTHOCHORTON being largely present. *Habitat.*—Mediterranean shores. *Characters.*—Cartilaginous, filiform, repeatedly forked, of a variable colour, from white to brown, and having the odour of seaweed and a strongly saline and mucilaginous taste. *Chemistry.*—Mucilage and saline compounds.

FUCUS.—Bladder Wrack.—The thallus of Fucus vesiculosus, *Linn.*

N.O.—Fucaceæ. *Sub-class*—Phæophyceæ.

Syn.—Quercus Marina, Cutweed.

Habitat.—Rocky shores of the North Atlantic and North Pacific Oceans.

Characters.—From two to four feet long, having a flat branching thallus, half to one inch wide, with the margin entire, and a distinct midrib through its entire length. The air vesicles are spherical or oblong in shape, and are usually in pairs. When fresh the colour is brownish-green, and becomes nearly black on drying. It has a peculiar seaweed-like odour, and a mucilaginous and saline taste.

Chemistry.—Mucilage, mannite, odorous oil and bittter principle are present, and the dry plant yields from 14 to 20 per cent. of ash, which is rich in potassium in combination with the halogens.

Uses, etc.—As specific against obesity. An extract and fluid extract are contained in the B.P.C. *Dose.*—60 to 120 grains.

CHONDRUS.—Irish Moss.—The entire plant of Chondrus crispus, *Stackh.*

N.O.—Gigartinaceæ. *Sub-class*—Rhodophyceæ.

Syn.—Fucus crispus; Carrageen.

Habitat.—Found growing on the rocks of the European and American shores of the Atlantic.

Characters and Test.—Yellowish or white, horny, translucent, many-forked; when softened in water, cartilaginous; segments flat, wedge-shaped or linear, at the apex emarginate or two-lobed; it has a slight seaweed odour and a mucilaginous, somewhat saline taste. One part of it boiled for ten minutes with thirty parts of water yields a solution which gelatinizes on cooling.

Chemistry.—Mucilage (90 per cent.), 9·5 per cent. of which is soluble in cold water; ash (8 to 15 per cent.). There is also present ½ to 1 per cent. of nitrogen.

Uses, etc.—As nutritive and demulcent, and as an emulsifying agent. The B.P.C. includes a decoction.

Note.—Chondrus mammilosus (Gigartina mammilosa) sometimes occurs in Irish moss. It is distinguishable by its more prominent sporocarps. The name Irish "moss" is a misnomer; the plant is not a moss (Bryophyte) but an alga.

LAMINARIA.—Sea Tangle.—The thallus of Laminaria digitata, *Lamour*, and of L. Cloustoni, *Edmonst.*

N.O.—Laminariaceæ. *Sub-class*—Phæophyceæ (Phæosporeæ).

Habitat.—The shores washed by the Atlantic Ocean.

Characters.—A large seaweed with a leathery or membranous flat frond with a stalk, but without a midrib. The fructification is imbedded in the frond in spots. Laminaria digitata has a solid cylindrical stem, tapering upwards, of varying length; the frond is leathery, roundish-oblong, and when quite young, entire, rapidly becoming deeply cleft into several strips.

Chemistry.—Dry matter (78·5 per cent.), containing nitrogen (1·5 per cent.) with gelatinous and mucilaginous principles; moisture (21·5 per cent.)

Uses, etc.—It is used in a variety of ways, but chiefly as a fuel, and when young as a food. Turned into cylinders and cones (Laminaria tents) it

has been used in cases of stricture and fistula and in gynæcological practice as a dilator, also when in powder as a useful ingredient in resolvent poultices. Its stems constitute the "goître-sticks" which are chewed by the South Americans. Its ash (*kelp* or *varec*), as also that of algæ generally, is rich in iodides, bromides and chlorides, in combination with much potassium and magnesium, and, in fact, constitutes an important source of iodine.

Note.—Agar agar is a seaweed gathered on East Indian Coasts and sent to China; it is derived from various species of SPHÆROCOCCUS, EUCHEUMA, and GELIDIUM, and is of a brownish-white colour, with thorn-like projections on its branches. It is the source of Chinese gelatine, and its jelly is used for bacteriological cultures. Agar-agar contains *gelose*, which is a powerful gelatinizing agent, precipitated from solution by alcohol. Three varieties of agar-agar met with in commerce are Ceylon, Macassar and Japanese, the latter is the most esteemed.

CEREVISIÆ FERMENTUM.—**Beer Yeast.**—The ferment obtained in brewing beer, and produced by Saccharomyces (Torula) cerevisiæ, *Meyen*.

Sub-class—Saccharomycetes (Ascomycetes).

Syn.—Faex medicinalis.

Characters.—Viscid, semi-fluid, frothy, or in a compressed pasty form exhibiting under the microscope numerous isolated roundish or oval cells, or short branched filaments composed of united cells; odour peculiar, taste bitter.

Chemistry.—Payen found dry yeast to consist of protein (62·73 per cent.), cellulose (29·37 per cent.), fat (2·10 per cent.), and ash (5·8 per cent.). The ash consists almost entirely of phosphate of potassium. Added to a solution of pure sugar, fermentation occurs with production of alcohol, carbon dioxide, glycerin and other less important bodies. The yeast plant however does not enter into active growth unless nitrogenous matter and certain mineral substances are also present.

Uses, etc.—Antiseptic and stimulant; in poultice for ulcers, etc.; formerly official. *Dose.*—½ to 1 ounce.

Note—Extract of yeast possesses an odour and taste closely resembling meat extract, for which it has been substituted.

USTILAGO.—Corn Smut.—Ustilago Maydis, grown upon Zea Mays.

N.O.—Ustilaginaceæ. *Sub-class*—Æcidiomycetes.

Syn.—Corn Ergot.

Habitat.—United States of America.

Characters.—Irregular, globose masses, sometimes six inches thick, consisting of a blackish membrane, enclosing innumerable brownish-black, globular and nodular spores; odour and taste unpleasant. It should be preserved in a dry place, and should not be kept longer than a year.

Chemistry, uses, etc.—Similar to those of ergot.

ERGOTA.—Ergot.—The sclerotium of Claviceps purpurea, *Tulasne*, originating in the ovary of Secale cereale, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 303].

Sub-class—Ascomycetes.

Syn.—Secale cornutum; Secale clavatum; spurred rye.

Habitat.—Europe (indigenous).

B.P. Characters and Test.—Subcylindrical or somewhat triangular, tapering towards the ends, generally curved; from one-third of an inch to an inch and a half (one to four centimetres) in length; longitudinally furrowed on each side, but more especially on that which is concave; often irregularly cracked; very dark violet-black externally, whitish or pinkish-white within; fracture short. Odour peculiar and disagreeable, especially if the powder be triturated with *solution of potassium hydroxide*; taste disagreeable. Ergot should be free from mustiness; it is liable to deteriorate by keeping and by exposure to damp.

Note.—There are three stages in the life history of this fungus.

1st. The ovary of the young Rye flower is infected by the *ascospores* of the fungus, hyphal filaments are produced and form a *mycelium* which gives rise to *conidia*. At the same time a sweet fluid "honey-dew" is excreted, attracting insects and thereby distributing those conidia or asexual spores upon the flowers of other rye-plants.

2nd. A *sclerotium* is produced by the absorption of the ovarian tissue; this consists of a compact dark violet mass of cells which by reason of the union of the hyphal filaments resembles parenchyma. This sclerotium constitutes the ergot of commerce.

3rd.—The sclerotium eventually falls to the earth and remains in a resting condition during the winter. In the spring growth again takes place and hyphæ are formed which bear wart-like excrescenses (*stromata*) on the surface of which are numerous *perithecia*. Each perithecium contains numerous *asci* or spore-cases, and these in turn contain numerous filiform *ascospores* which are eventually liberated and carried by the wind to the grain in flower.

Chemistry.—Ergot contains many constituents, and published analyses are, so far, still at variance. The latest researches on the subject practically establish the main facts that the physiological activity of Ergot is to be attributed to its alkaloidal constituents and that its acid constituents are probably only active in proportion to the extent to which they are contaminated with basic principles *Ergotinine* ($C_{35}H_{39}O_5N_5$) and *ergotoxine* ($C_{35}H_{41}O_6N_5$) have been clearly established as definite alkaloidal principles. Ergotoxine is the chief active constituent and in constitution is the hydrate of ergotinine. It is identical with the hydro-ergotinine of Kraft and is amorphous, the salts of the base however are crystalline and in this way it has been purified. Ergotinine is inferior in activity, is crystalline but forms amorphous salts, it is readily convertible into ergotoxine by hydrolysis. Of the other basic constituents described, *picro-sclerotine*, *secaline* and *sclero-crystalline* are probably identical with ergotinine, *cornutine* is probably a decomposition product containing ergotoxine. *Ergotinic*, *sphacelinic*, *sclerotinic* acids have been described, but it is doubtful to what extent these can be regarded as pure products. Ergot also contains about 30 per cent. of fixed oil which may be removed by petroleum spirit in which the alkaloids are not soluble. Ash 3 to 4 per cent.

Note.—Ergot deteriorates, and if not well dried and kept in closed vessels is liable to be attacked by minute insects (species of Acari). The stock should be renewed annually. The addition of a few drops of chloroform assists in its preservation. The

removal of the oil by means of petroleum spirit, or by expression, has also been suggested for the same purpose, but without general approval.

Detection of Ergot in Flour and Bread.—Macerate in ether acidulated with diluted sulphuric acid for twenty-four hours; shake up the ethereal solution with a concentrated solution of sodium carbonate; the latter acquires a reddish-violet colour if ergot be present.

Uses, etc.—For contraction of uterus, and as hæmostatic. *Dose.*—20 to 60 grains.

B.P. Preparations.

*Extractum Ergotæ	alcoholic.
,, ,, Liquidum	1 part in 1.
Infusum Ergotæ	1 ,, 20.
Tinctura Ergotæ Ammoniata	1 ,, 4

of a mixture of alcohol (60 per cent.) and solution of Ammonia.

**Used in the preparation of*

Injectio Ergotæ Hypodermica	1 part in 3.

B.P.C. Preparations.—Extractum Ergotæ Ammoniatum Liquidum, Tinctura Ergotæ, Mistura Ergotæ, Vinum Ergotæ.

VARIETIES OF ERGOT.—Commercially, Spanish, Russian and German Ergots are met with. Spanish is the boldest and usually most esteemed, physiological experiments however have shown the Russian to be usually more active.

SUBSTITUTIONS OF ERGOT.—The ergot from other graminaceous plants:—*Ergot of wheat*, which is shorter and thicker than the official kind; *ergot of oat* is much more slender; *ergot of diss* (the ergot of ARUNDO AMPELODESMOS, a North African grass), which is said to be twice as active as that of rye.

AGARICUS ALBUS.—White Agaric.—The fungus Polyporus officinalis, *Fuis* (Boletus Laricis), found growing on the Larch.

N.O.—Polyporaceæ. *Sub-class*—Basidiomycetes.

Syn.—Fungus laricis, Purging Agaric.

Habitat.—Europe.

Characters.—Deprived of outer rind; hoof-shaped or conical, about six inches broad, usually in irregular pieces; white, light, somewhat fibrous and spongy, friable; odour faint; taste sweetish, acrid and bitter.

Chemistry.—*Agaric* (*agaricinic, laricic*) *acid* is the valuable principle. It is obtained in minute, white, lustrous crystals, slightly soluble in cold, readily in hot water. *Agaricin* is either an alcoholic extract consisting of impure agaric acid, or the two are sometimes regarded as being synonymous.

Uses, etc.—Recommended in night-sweats of phthisis; is a powerful purgative. *Dose.*—5 to 30 grains in powder; usually given in the form of agaric acid, of which the dose is $\frac{1}{4}$ to 1 grain.

Note.—Allied Fungi. AGARICUS (AMANITA) MUSCARIA (*fly-agaric*), yields the uncrystallisable alkaloid *muscarine* ($C_5H_{15}NO_3$), the nitrate of which is used in medicine for purposes similar to pilocarpine. POLYPORUS IGNIARIUS and P. FOMENTERIUS (*agaric of the oak—surgeon's agaric*) was formerly much used, after being specially prepared by peeling, etc., for stopping hæmorrhage, etc. Treated with a solution of nitre, prepared agaric becomes tinder, or the *amadou* of the French.

CETRARIA.—Iceland Moss.—The dried lichen, Cetraria islandica, *Acharius*.

Sub-class—Ascolichenes.

Syn.—Iceland lichen.

Habitat.—Northern Europe, etc.

Characters.—Foliaceous, much branched in an irregular dichotomous manner into fringed obtuse or truncate flattened lobes; crisp, smooth, and usually brownish or greyish-white above, whitish beneath, and marked irregularly with small white depressed spots (*apothecia*). Almost odourless when dry, but when moistened with water having a feeble seaweed-like odour; taste mucilaginous and slightly bitter. A strong decoction gelatinises on cooling.

Chemistry.—*Lichen-starch* ($C_{12}H_{20}O_{10}$) and *cetrarin*; lichen-starch is present to the extent of about 40 per cent., and consists of a mixture of *lichenin* and *isolichenin* (*lichenoid*); the former is insoluble in cold water and is but slightly coloured by iodine, the latter is somewhat soluble in cold water and is coloured deep blue by iodine. Cetrarin, the bitter principle, is soluble in alcohol and in alkalies; it may be split up into *cetraric acid* ($C_{30}H_{30}O_{12}$), *lichen-stearic acid*, and a green colouring substance, *thallochlor*.

Uses, etc.—As demulcent and tonic, etc.; formerly official, a decoction is included in the B.P.C.

Note.—Iceland moss, deprived of some of its bitter principle by continued maceration in water, has been, and probably is still, used as an article of diet. Iceland "Moss" is of course not a moss but a lichen, the name lichen being applied to a class of Cryptogams in which the plant body is formed by the symbiotic union of an Alga and a Fungus. The powder (freed from bitter principle) is a useful demulcent and emulsifying agent.

LACMUS.—Litmus.—A blue pigment obtained from Lecanora tartarea; Roccella tinctoria; Roccella fusiformis, and from other lichens, as Variolaria and Parmelia.

Class—Lichenes.

Habitat.—The maritime rocks of Madeira, the Azores, Canary and Cape de Verde Islands.

Characters.—It is in earthy, friable cakes or cubes, of a deep blue or purplish-blue colour, having a slight saline and somewhat pungent taste. It effervesces with acids, and is partly soluble in water with a blue colour, and in dilute alcohol with a purplish-blue colour, which is changed to red by acids. It contains much gypsum and chalk. Litmus is prepared chiefly, it is said, in Holland by grinding the weed with pearlashes, and repeatedly moistening the mixture with ammonia water or urine. The mass passes in colour from brownish-red to purple, and finally blue; it is then mixed with chalk and gypsum and moulded.

Chemistry.—The lichens yielding litmus, orchil and cudbear contain acids or acid anhydrides, colourless themselves but yielding coloured pigments when subjected to the action of air, moisture and ammonia. *Azolitmin* is the most important of these and forms a blue salt when in combination with potassium as in litmus. In addition to azolitmin, litmus contains other colouring matters, viz., *erythro-litmin*, *erythrolein* and *spaniolitmin*; but since spaniolitmin is rarely present, and erythrolein gives reddish-purple with alkalies, the two remaining principles of the four must be considered to be the essential colouring matters.

Uses, etc.—Litmus is largely used as an indicator in testing fluids for alkalinity or acidity; the free colouring matter is red, while in combination with alkalies it is blue. For this purpose it is used in the form of an aqueous solution or in that of paper prepared from the latter.

Note.—*Orchil* (*archil*) is prepared as a thickish liquid in the same way as litmus (*see above*) but without the addition of pearlashes and the final admixture with chalk and gypsum; it is used as a dye. *Cudbear* is a purplish-red powder, prepared by evaporating an ammoniacal infusion of the lichens to dryness, and afterwards reducing to powder; it is also used as a dye.

FILIX MAS.—Male Fern.—The rhizome of Aspidium Filix-mas, *Swartz* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 300]. Collected late in the autumn, divested of its roots, leaves, and dead portions, and carefully dried.

N.O.—Polypodiaceæ.

Syns.—Lastræa Filix Mas, Nephrodium Filix Mas, Polypodium Filix Mas, Dryopteris Filix Mas, Aspidium.

Habitat.—Indigenous.

B.P. Characters.—From three to six inches (seven and a half to fifteen centimetres) or more in length, the rhizome itself from three-quarters to one inch (two to two and a half centimetres) in diameter. Entirely covered with the hard, persistent, curved, angular, dark-brown bases of the petioles, which bear numerous brown membranous scales. The rhizome is brown externally, but green internally. The bases of the petioles are also green internally, and exhibit in transverse section about eight pale yellow fibro-vascular bundles in each, arranged in a diffuse circle. Odour feeble but disagreeable; taste sweetish and astringent at first, but subsequently bitter and nauseous.

Male Fern should not be kept more than a year.

Chemistry.—A green fixed oil (6·9 per cent.), a little volatile oil, resin (4·1 per cent.), *filicitannic acid* (insoluble in ether, 7 per cent.), starch, gum, and crystallisable sugar. The ash amounts to from 2 to 3 per cent. The activity of Male Fern is attributed to *filmaron*, an amorphous acid existing in the rhizome to the extent of 5 per cent. Filmaron is a straw-coloured powder soluble in acetone, chloroform, etc., insoluble in water, melting point 60° C. In solution filmaron is gradually decomposed into filicic acid and aspidinol. *Filicic acid*, *flavaspidic acid*, *albaspidin* and *aspidinol* have been isolated but have been shown to be without decided activity.

Uses, etc.—As tænifuge.

B.P. Preparation.

Extractum Filicis Liquidum - ethereal; also known as Oil of Male Fern.

Note.—The U.S.P. includes, beside the above, the rhizome of DRYOPTERIS (ASPIDIUM) MARGINALIS, which in cross section shows only about six vascular bundles. *Inkomankomo* is the name given in South Africa to the rhizome of A. ATHAMANTICUM, which in Europe receives the name of *pannum*.

Aspidium spinnulosum may be substituted for the official drug, it is similarly active and contains *aspidin*. The rhizome is distinguishable by reason of its scales carrying glandular hairs.

ADIANTUM.—Maidenhair.—The fern Adiantum capillus-veneris, *Linn.*

N.O.—Polypodiaceæ.

Habitat.—South of England and Europe.

Characters.—Rhizome perennial, oblique, three to four inches long, thickness of a quill, brownish, clothed with shaggy hairs and occasional

slender fibres, these constituting the true root. Fronds six to twelve inches long, twice or thrice pinnate, usually broadly ovate in general outline, and with a thin, slender stalk of a shining brownish-black appearance. Segments obovate or fan-shaped, half an inch broad, all narrowed at the base into a short, slender stalk, more or less divided into wedge-shaped, obtuse lobes, thin, and of a bright green, without any midrib, but with numerous furcate veins converging at the base. The sori are conspicuous on the extremities of most of the segment lobes.

Chemistry.—Mucilage, tannin, etc.

Uses, etc.—In pectoral complaints. The French have a Sirop de Capillaire (Syrup of Maidenhair), which is prepared from the fronds and rhizomes of this plant.

LYCOPODIUM.—**Lycopodium.**—The spores of Lycopodium clavatum, *Linn.* (the Common Club Moss) and of other species of Lycopodium.

N.O.—Lycopodiaceæ.

Syn.—Vegetable sulphur.

Habitat.—Central Europe.

Characters.—A fine, pale yellowish, very mobile, inodorous, and tasteless powder, floating upon water and not wetted by it, and burning quickly when thrown into a flame. Under the microscope the granules are seen to be four-sided, reticulated, and to have short projections on the edges. Lycopodium should be free from pollen, starch, sand, and other impurities, many of which may be detected by the microscope.

Chemistry.—Fixed oil (47 per cent.), ash (5 per cent.).

Uses, etc.—Has been prescribed in the form of tincture; its chief pharmaceutical use is as a pill-powder. Official in the U.S.P.

SECTION II.

UNORGANISED DRUGS OF VEGETABLE ORIGIN.

Under this head are included vegetable secretions and such other plant products as have no definite organised structure.

1. JUICES.—SUCCI.

The juices are met with in one of three forms. They may be liquids (lemon juice), solids (kino), or of a pasty consistence (opium). Existing in the plant as liquids, the two latter varieties reach the solid or pasty condition by evaporation, which may have been brought about by natural means (*i.e.*, by exposure to the atmosphere), as in the case of opium, or by artificial means, *e.g.*, catechu. The majority of the medicinal juices may be regarded as being derived from the laticiferous vessels of the plants which yield them, but the liquid juices (lemon juice, etc.) consist of the cell-sap of the succulent fruits, containing dissolved vegetable acids.

OPIUM.—Opium.—The juice obtained by incision from the unripe capsules of Papaver somniferum, *Linn.*, inspissated by spontaneous evaporation.

N.O.—Papaveraceæ.

Syns.—Meconicum, Thebaica, Succus thebaicus.

Habitat.—Asia Minor, India, Persia, etc.

Any suitable variety of opium may be employed as a source of Tincture of Opium and Extract of Opium of the respective official alkaloidal strengths, provided that when dry it contains not less than seven and a half per cent. of anhydrous morphine; but, when otherwise used for officially recognised purposes, opium must be of such a strength that when dried, and powdered, the powder heated to 212° F. (100° C.) until it ceases to lose moisture, and the product tested by the official method, such dry powder shall yield not less than nine and a half per cent., and not more than ten and a half per cent., of anhydrous morphine. Opium yielding when dried more than ten per cent. of anhydrous morphine may be diluted to that percentage with any opium containing when dry between seven and a half and ten per cent. of anhydrous morphine, or with milk sugar.

Note.—The standard of morphine content chosen by the 1898 B.P. is singularly low in view of the fact that unsophisticated Turkey opium averages (when dry) about 13 per cent. of morphine. Similarly it would be difficult, if not impossible, to obtain any except possibly an Indian opium containing (when dry) between 7½ and 10 per cent. of morphine while dilution of powdered opium with the large proportion of milk sugar often required gives an unsatisfactory product. It may be noted that the U.S.P. requires *Opii Pulvis* to yield 12 to 12½ per cent. of Morphine.

B.P. Characters.—Usually in rounded, irregularly formed, or flattened masses, varying in weight, but commonly from about eight ounces to two pounds (two hundred and fifty to one thousand grammes). When fresh, plastic, and internally somewhat moist, coarsely granular, or nearly smooth, and reddish or chestnut brown; but becoming harder on keeping, and darkening to blackish-brown. Odour strong and characteristic; taste bitter.

Varieties of Opium:—

Turkey Opium.—This and the Persian are the varieties chiefly made use of in Great Britain, and the former is correctly described in the official characters. It is produced in Asiatic Turkey, and exported from Smyrna and Constantinople; that from Constantinople differs but little from the Smyrna export except in having more marked poppy leaf and less, if any, rumex fruits.

Egyptian Opium occurs in flat circular cakes, four inches or more in diameter, it never darkens in colour by age, but is always reddish-brown, and was formerly covered with the leaf of a species of plane, having parallel venation, but may now be met with enclosed in poppy leaves, but without the rumex capsules. It contains usually little more than half as much morphine as Turkey opium.

Persian or *Trebizond Opium* formerly occurred in sticks about six inches long and half an inch in diameter, each enveloped in paper and tied with a little cotton, but now it may be met with in large, irregular, roundish lumps covered with paper. When cut through, the lumps frequently exhibit oily globules, which have found their way into the mass from the operator during collection using linseed oil to moisten the knife and hands. It was formerly considered to be an inferior kind, but has much improved of late years and is largely employed in the manufacture of morphine.

Indian Cannon Ball Opium, prepared in India and sent to China, occurs in balls, weighing from three to four pounds, and surrounded with poppy leaves.

Chinese Opium.—This is produced and consumed entirely in China.

Method of Production.—The incisions are made in the capsules in India vertically, in Asia Minor horizontally, while in China the capsules are punctured; care has to be taken not to incise too deeply or the juice which proceeds from the laticiferous vessels flows into the capsules and, mingling with the seeds, is spoiled. The exudation dries in about twenty-four hours, and is then collected and thrown into a mass without mixing. This feature distinguishes Smyrna opium from all others, and it is hence known as granular opium. It is enveloped in poppy leaves and the trigonal fruits of a species of rumex. In India, opium is similarly collected, but is, after removal, beaten or kneaded into a homogenous mass.

The following table, gives the formulæ, solubilities and the more important colour reactions of the opium bases.

OPIUM BASES—Table of Solubilities in Alcohol, Caustic Soda, and Ether, and Colour Reactions with Nitric Acid and Ferric Chloride.

Alkaloid.	*Formula.*	*Solubility in*			*Reaction with*	
		Alcohol.	*Solution of Caustic Soda.*	*Ether.*	*Nitric Acid, S.G. 1·42.*	*Ferric Chloride.*
Morphine	$C_{17}H_{19}NO_3$.	100	readily	6100	orange red	greenish-blue
Codeine	$C_{18}H_{21}NO_3$.	readily	slightly	readily	yellow; not becoming red	no colour
Thebaine	$C_{19}H_{21}NO_3$.	10	not	140	yellow; not becoming red	no colour
Apomorphine	$C_{17}H_{17}NO_2$.	readily	soluble	very	blood-red or reddish violet	pink to violet to black
Pseudomorphine	$C_{34}H_{36}N_2O_6$.	scarcely at all	soluble	not	orange-red; becoming yellow	blue
Papaverine	$C_{20}H_{21}NO_4$.	45 cold; 4 hot	not	250	yellow	no colour
Meconidine	$C_{21}H_{23}NO_4$.	readily	not	easily	orange-red	
Codamine	$C_{20}H_{25}NO_4$.	readily	soluble	soluble	dark-green	
Laudanine	$C_{20}H_{25}NO_4$.	sparingly	readily	647	orange-red	emerald green
Laudanosine	$C_{21}H_{27}NO_4$.	readily	not	19		
Lanthopine	$C_{23}H_{25}NO_4$.	sparingly	soluble	sparingly	orange-red	
Protopine	$C_{20}H_{19}NO_5$.	sparingly	not	sparingly		
Cryptopine	$C_{21}H_{23}NO_5$.	sparingly	soluble	soluble		
Rhœadine	$C_{21}H_{21}NO_6$.	scarcely at all	not	1280		
Narcotine	$C_{22}H_{23}NO_7$.	190 cold; 13 hot	not	50	red	no colour
Oxynarcotine	$C_{22}H_{23}NO_8$.	sparingly	soluble	not		
Narceine	$C_{23}H_{29}NO_9$.	300 cold; easily hot	soluble	not	yellow; fading rapidly	
Tritopine	$C_{42}H_{54}N_2O_7$.	soluble	soluble	sparingly		
Gnoscopine	$C_{22}H_{23}NO_7$.	1500	not	sparingly		
Hydrocotarnine	$C_{12}H_{15}NO_3$.	readily	not	readily		
Xanthaline	$C_{37}H_{36}N_2O_9$.	sparingly				

Chemistry.—Morphine, the most important base contained in opium, was discovered in 1816, and since then the alkaloids named in the preceding list have also been found. The amount of morphine present in good Turkey Opium is from 10 to 12 per cent. There are also present sulphuric acid, *meconic acid* ($C_7H_4O_7$), lactic acid, mucilage, pectic matter, sugar and wax. The amount of dry extract yielded to water is about 45 to 55 per cent.

Uses, etc.—As anodyne, antispasmodic and hypnotic, etc. *Dose.*—$\frac{1}{2}$ to 2 grains in powder.

B.P. Preparations.

Emplastrum Opii - - -	containing 1 in 10 of opium.
*Extractum Opii - - -	,, 20% morphine.
Pilula Ipecacuanhæ cum Scilla -	,, 1 in 20 of opium.
,, Plumbi cum Opio - -	,, 1 in 8 of opium.
,, Saponis Composita - -	,, 1 in 5 of opium.
Pulvis Cretæ Aromaticus cum Opio	,, 1 in 40 of opium.
,, Ipecacuanhæ Compositus	,, 1 in 10 of opium.
,, Kino Compositus - -	,, 1 in 20 of opium.
,, Opii Compositus - -	,, 1 in 10 of opium.
Suppositoria Plumbi Composita - -	1 grain in each.
†Tinctura Opii - - - -	containing 0·75% morphine.
Unguentum Gallæ cum Opio -	,, 1 in 13, nearly, of opium.

**Used in*

Extractum Opii Liquidum -	containing 0·75% morphine.

†*Used in*

Linimentum Opii - - - ÷ -	1 part in 2.
Tinctura Camphoræ Composita,	containing 0·05% morphine.
Tinctura Opii Ammoniata -	,, 0·115% morphine.

B.P.C. Preparations.—Acetum Opii, Liquor Opii Sedativus, Tinctura Opii crocata, Tinctura Opii deodorata, Vinum Opii, Linimentum Opii Ammoniatum, Enema Opii, Confectio Opii, Tinctura Ipecac. et Opii, etc.

THE OFFICIAL CHARACTERS OF THE OPIUM ALKALOIDS AND THEIR SALTS.

Morphinæ Acetas P.B. (Morphine Acetate), the carefully dried salt, $C_{17}H_{19}NO_3.C_2H_4O_2,3H_2O$. produced by neutralising morphine with acetic acid, is obtained as a white crystalline or amorphous powder, almost entirely soluble in $2\frac{1}{2}$ parts of water and in about 100 parts of alcohol (90 per cent.). It loses acetic acid when exposed to the air. It affords the reactions for morphine mentioned under "Morphinæ Hydrochloridum," and the reactions characteristic of acetates. 2 grammes of the salt form, with six cubic centimetres of warm morphinated water, a slightly turbid solution, which is rendered clear by the addition of 0·1 cubic centimetre of acetic acid; and this solution, when mixed with solution of ammonia in slight excess, yields a precipitate which, after washing and drying as described under "Morphinæ Hydrochloridum," weighs 1·42 grammes. If

the salt yield a larger proportion of morphine than this, it should be recrystallised from hot water acidulated with acetic acid. Heated to redness with free access of air, it leaves no residue (absence of mineral impurities).

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ grain.

B.P. Preparation.

Liquor Morphinæ Acetatis - - - - - - 1 in 100.

Morphinæ Hydrochloridum P.B. (Morphine Hydrochloride), the hydrochloride, $C_{17}H_{19}NO_3,HCl,3H_2O$, of an alkaloid present in opium, is obtained in the form of acicular prisms of a silky lustre, or a white powder consisting of minute cubical crystals, unchanged by exposure to the air. Soluble in 24 parts of cold water, 1 part of boiling water, and in 50 parts of alcohol. It should be without action on litmus. Solution of ammonia causes a white precipitate in the aqueous solution, with difficulty soluble in excess; solution of potassium hydroxide a similar precipitate readily soluble in excess. This precipitate yields mere traces to benzol (absence of other alkaloids). Moistened with nitric acid the salt yields an orange-red coloration; with test solution of ferric chloride a dull greenish-blue coloration. Heated on a water-bath for ten or fifteen minutes with a few drops of sulphuric acid, cooled, and treated with a few drops of diluted nitric acid, it gives a violet colour rapidly passing to blood-red. It dissolves without coloration in strong sulphuric acid; the addition of a small quantity of sodium arsenate to a portion of this solution causes a bluish-green coloration, and a small quantity of bismuth oxynitrate added to another portion gives a purplish-brown coloration. It affords the reactions characteristic of hydrochlorides. 2 grammes of morphine hydrochloride dissolved in 250 cubic centimetres of warm morphinated water, with solution of ammonia added in the slightest possible excess, will give on cooling, a crystalline precipitate which, when washed with a little cold morphinated water and dried, should weigh 1·51 grammes. The drying should be accomplished, first by pressing the precipitate between sheets of bibulous paper, then by exposing it to a temperature between 131° and 140° F. (55° and 60° C.), and finally to a temperature of 230° F. (110° C.) for twenty minutes. Heated to redness with free access of air, it burns, leaving no residue (absence of mineral impurities).

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ grain.

B.P. Preparations.

Liquor Morphinæ Hydrochloridi - - - - 1 in 100.
Suppositoria Morphinæ - - - - - - $\frac{1}{4}$ grain in each.
Tinctura Chloroformi et Morphinæ Composita - 1 in 100.
Trochiscus Morphinæ - - - - - - $\frac{1}{36}$ grain in each.
,, Morphinæ et Ipecacuanhæ - - - $\frac{1}{36}$,, ,,

Morphinæ Tartras P.B. (Morphine Tartrate) $(C_{17}H_{19}NO_3)_2C_4H_6O_6,3H_2O$, may be prepared by the combination of morphine and tartaric acid in molecular proportions. It occurs as a white powder consisting of nodular tufts of minute acicular crystals. Efflorescent at 68° F. (20° C.). Soluble in 11 parts of cold water, almost insoluble in alcohol (90 per cent.). It affords the reactions characteristic of morphine and of tartrates. 2 grammes dissolved in 20 cubic centimetres of warm morphinated water, with solution of ammonia added in the slightest possible excess, will give, on cooling, a crystalline precipitate, which, after washing and drying as described under "Morphinæ Hydrochloridum," should weigh 1·47 grammes. Heated to redness with free access of air, it burns without leaving any residue (absence of mineral impurities). *Dose.*—$\frac{1}{8}$ to $\frac{1}{2}$ grain.

B.P. Preparations.

Injectio Morphinæ Hypodermica - - - - - 1 in 20.
Liquor Morphinæ Tartratis - - - - - - 1 in 100.

Codeina P.B. (Codeine), an alkaloid, in constitution methyl-morphine, $C_{17}H_{18}(CH_3)NO_3,H_2O$, obtained from opium or from morphine, is in colourless or nearly colourless trimetric crystals, soluble in 80 parts of water or of solution of ammonia, is readily soluble in alcohol (90 per cent.), in chloroform, and in diluted acids. It is soluble in 30 parts of ether. The aqueous solution has a bitter taste and an alkaline reaction. The alkaloid dissolves in an excess of sulphuric acid, forming a colourless solution, a small quantity of which, when gently warmed on a water-bath with 2 drops of solution of ammonium molybdate, or with a trace of ferric chloride or potassium ferricyanide, develops a blue or bluish-black colour, which, on the addition of a minute trace of diluted nitric acid, changes to a bright scarlet, becoming orange. Heated to redness in air it yields no ash. Moistened with nitric acid the liquid becomes yellow but not red. A 2 per cent. solution of codeine in water acidulated with a few drops of hydrochloric acid, gives a whitish precipitate with solution of potassium hydroxide, but not with solution of ammonia. A saturated solution of codeine in water acidulated with hydrochloric acid, should give no blue colour, but only gradually a dull green on the addition of test solution of ferric chloride and a very dilute solution of potassium ferricyanide (absence of morphine and other impurities).

Dose.—$\frac{1}{4}$ to 2 grains.

B.P. Preparations.

Codeinæ Phosphas, *contained in*
Syrupus Codeinæ - - - - $\frac{1}{4}$ grain in each fluid drachm.

Apomorphinæ Hydrochloridum P.B. (Apomorphine Hydrochloride), the hydrochloride, $C_{17}H_{17}NO_2,HCl$, of an alkaloid obtained by heating morphine hydrochloride or codeine hydrochloride in sealed tubes with hydrochloric acid, crystallizes in the form of small, greyish-white, shining acicular crystals, turning green on exposure to light and air, inodorous. Soluble in 50 parts of water and more soluble in alcohol (90 per cent.), the solutions being decomposed with production of a green colour when they are boiled. Neutral or very feebly acid to solution of litmus. From solutions, solution of sodium bicarbonate throws down a precipitate which becomes green on standing and then forms a liquid which is purple with ether, violet with chloroform, and bluish-green with alcohol (90 per cent.). With dilute test-solution of ferric chloride it gives a deep red, and with nitric acid a blood-red coloration. If the salt impart an emerald-green colour to 100 parts of water after shaking the mixture, it should be rejected.

Dose.—$\frac{1}{20}$ to $\frac{1}{10}$ grain, by hypodermic injection; by the mouth, $\frac{1}{10}$ to $\frac{1}{4}$ grain.

B.P. Preparation.

Injectio Apomorphinæ Hypodermica - - - - 1 in 100.

Note.—Non-official alkaloids and preparations :—

Morphina, *Morphine* (*morphia*), $C_{17}H_{19}NO_3$, is a white crystalline powder, obtained by methods similar to those adopted for the assay of opium (*vide opium*). It is insoluble, or nearly so, in ether; soluble in alkalies, in acetic ether, in boiling amylic alcohol, and in oleic acid (*morphinæ oleas*). It forms crystallisable salts with acids, gives a blue colour with ferric chloride, and a red when dissolved in sulphuric acid and a drop of nitric acid added. The morphine molecule contains two hydroxyl groups.

Morphinæ Sulphas $(C_{17}H_{19}NO_3)_2,H_2SO_4,5H_2O$, formerly official, may be obtained by a process similar to that used for obtaining the hydrochloride; sulphuric acid being substituted for hydrochloric. It is obtained in colourless acicular crystals, soluble in about 20 parts of water.

Acidum Meconicum, $H_2C_7H_2O_7,3H_2O$, formerly official, is an acid obtained from opium. It occurs in nearly colourless, micaceous crystals, sparingly soluble in water. It may be obtained by treating opium with calcium chloride or lead acetate, the precipitated meconate being decomposed by treatment with acids. It is peculiar to opium, and with ferric chloride gives a red colour.

Morphinæ Bimeconatis, Liquor, formerly official, is prepared by dissolving freshly precipitated morphine in meconic acid; it was said to be specially useful as representing the natural state of combination of acid and alkaloid existing in the crude drug.

Acetomorphinæ Hydrochloridum, Benzylmorphinæ Hydrochloridum, Ethylmorphinæ Hydrochloridum are the names given in the B.P.C. to the hydrochlorides of acetyl, benzyl and ethyl derivates of morphine.

LIMONIS SUCCUS.—Lemon Juice.—The freshly expressed juice of the ripe fruit of Citrus medica *var.* β Limonum.

N.O.—Rutaceæ.

Habitat.—Southern Europe.

Characters.—A slightly turbid, yellowish liquid with a sharp acid taste. S.G. 1·030 to 1·040. Quantity of citric acid in one fluid ounce—30 to 40 grains. The evaporated extract of the juice should not yield more than 3 per cent. of ash.

Chemistry.—Citric acid, gum, sugar, inorganic salts, and a trace of volatile oil.

Note.—Lemon juice, which decomposes on keeping, is frequently adulterated with tartaric and sulphuric acids, etc. It may be preserved by the addition of 10 per cent. of alcohol.

Uses, etc.—As refrigerant and antiscorbutic. *Dose.*—½ to 2 fluid ounces. A source of citric acid.

B.P. Preparation.
Syrupus Limonis.

Note.—Limettæ Succus, Lime Juice is very similar in composition and in the amount of citric acid present. Lemon and Lime Juices are used in the manufacture of Citric Acid, either the concentrated juice or a crude Calcium Citrate is imported and worked up into the pure acid.

KINO.—Kino.—The juice obtained from incisions in the trunk of Pterocarpus Marsupium, *Roxb.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 81], evaporated to dryness.

N.O.—Leguminosæ.

Habitat.—S. India.

B.P. Characters and Tests.—In small angular glistening opaque reddish-black brittle fragments, which in thin laminæ and at the edges are transparent and ruby-red; inodorous; very astringent, and when chewed tinges the saliva red. Partially soluble in cold *water*; almost entirely soluble in *alcohol* (90 per cent.). Yields little or nothing to *ether*. Not less than 80 per cent. should be soluble in boiling *water*.

Chemistry.—Kino-tannic acid (70 to 75 per cent.), *kino-red* a phlobaphene formed by oxidation of the former; gallic acid, *kinoic acid*, pectin, pyrocatechin, ash, etc. *Kinoin*, a crystalline, colourless substance, while probably present in some kinos, has been shown absent from the official Malabar Kino. It

has also been recently shown that the gelatinisation of Tincture of Kino is due to the progressive action of a ferment or *oxydase*, kino-tannic acid being gradually converted into kino-red. This gelatinisation can be prevented if the ferment be destroyed by boiling the tincture.

Uses, etc.—As astringent, etc. *Dose.*—10 to 30 grains.

B.P. Preparations.

Pulvis Catechu Compositus	-	-	1 part in 5.
„ Kino „	-	-	3 parts in 4.
Tinctura Kino	-	-	1 part in 10 of a mixture of alcohol (90 per cent.), glycerin and water.

Dose, in powder.—5 to 20 grains.

Note.—Kinos.—The word kino is a generic term applied to many astringent gums and inspissated juices. In addition to the official East Indian or Malabar kino the following may be mentioned:—*West India* or *Jamaica Kino*, the product of Coccoloba uvifera (*N.O.*—Polygonaceæ; sea-side grape), is dark red-brown in colour, almost entirely soluble in water and rectified spirit. It is said to be prepared by evaporating a decoction of the wood and bark of the tree. *South American Kino, Caraccas Kino*, is probably identical with West India Kino. *African Kino*, Gambia Kino (Pterocarpus erinaceus), was the substance first introduced as kino by Dr. Fothergill. An African kino, said to be derived from Brachystegia spicæformis, has been described; it is highly astringent, and gives a brighter solution than the official variety. *Angophora Kino.*—Certain species of Australian angophoras (A. lanceolata, etc.) yield kinos similar in composition to others of the class, but possessing a marked odour.

Butea Gum or Bengal Kino is the product of Butea frondosa, *Roxb.* (*N.O.*—Leguminosæ) and is similar to the official variety in appearance It is included in the Indian and Colonial Addendum.

CATECHU NIGRUM.—Black Catechu.—An aqueous extract obtained from the wood of Acacia Catechu, *Willd.*, a small tree.

N.O.—Leguminosæ.

Syn.—Black or Pegu Catechu, Cutch.

Habitat.—Burmah, India, etc.

Characters.—It is of a dark colour, hard and brittle, dissolves slowly in the mouth; its fracture has a frothy, porous, or bubble-like appearance, which is due to a kind of fermentation. Should contain not more than 15 per cent. of matters insoluble in alcohol. Odourless, taste astringent and sweetish.

Note.—The heartwood boiled with water, the decoction evaporated until thick, and poured into clay or leaf moulds and dried, yields the substance known in commerce as the above. The word *catechu* means the juice of a tree, but is usually applied to astringent extracts obtained from various plants.

Chemistry.—Catechu-tannic acid (25 to 45 per cent.), *aca-catechin* (2 to 10 per cent.), *catechu-red* (an anhydride of aca-catechin), *quercetin*, etc. The fluorescent principle found in gambir is absent.

Uses, etc.—As Catechu Pallidum (*q.v.*). *Dose.*—10 to 30 grains. Formerly official in the United States, and now recognised in the Indian and Colonial Addendum; much used in the arts for purposes for which tannin is required.

Note.—Allied Drugs.—The following varieties of Catechu are described as being imported into the United States:—*Cake Catechu* from East Indies, *Pegu Catechu* from Burmah, *Bengal Catechu*, in quadrangular cakes, *Ball Catechu*, said to come from Bombay.

EUCALYPTI GUMMI.—Eucalyptus Gum.

A ruby-coloured exudation, or so-called red gum, from the bark of Eucalyptus rostrata, *Schlecht.* [*Mueller, Eucalyptographia*], and some other species of Eucalyptus. Imported from Australia.

N.O.—Myrtaceæ.

Syn.—Red Gum, Botany Bay Kino.

Habitat.—Australia.

B.P. Characters and Tests.—In grains or small masses. Thin fragments are transparent and of a ruby-red or garnet-red colour. It is somewhat tough and has a very astringent taste. When chewed it adheres to the teeth and tinges the saliva red. Cold *water* dissolves from 80 to 90 per cent., forming a neutral solution. It is almost entirely soluble in *alcohol* (90 per cent.).

Chemistry.—*Kino-tannic acid* (47 per cent.), *kino-red*, gum, and in some species a volatile oil.

Uses, etc.—As astringent in diarrhœa and in the form of lozenge for sore throat, etc. *Dose.*—2 to 10 grains.

B.P. Preparation.

Trochiscus Eucalypti Gummi - 1 grain in each lozenge.

Dose.—2 to 10 grains.

Note.—Eucalyptus Gum is mostly prepared by evaporating the juice from incisions, but some is also collected from cavities in the the trunk of the tree.

CATECHU.—Catechu.

An extract of the leaves and young shoots of Uncaria Gambier, *Roxb.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 139].

N.O.—Rubiaceæ.

Syn.—Catechu Pallidum; Terra Japonica; Gambir.

Habitat.—Singapore and other places of Eastern Archipelago.

B.P. Characters and Tests.—In cubes which are sometimes more or less agglutinated. Each side measures about an inch (twenty-five millimetres). They are deep reddish-brown externally, pale cinnamon-brown internally, porous and friable. When examined under the microscope they are found to consist chiefly of minute acicular crystals. Taste at first bitter and very astringent, but subsequently sweetish; no odour. Almost entirely soluble in boiling *water*. 70 per cent. should be soluble in *alcohol* (90 per cent.). Catechu should not afford any characteristic reaction with the tests for starch, and should not yield more than 5 per cent. of ash when incinerated.

The leafy tops of the shrub are made into a decoction by the natives, and this is evaporated to a paste afterwards cut into cubes.

Chemistry.—Catechin (*catechuin, catechuic acid*) is a white crystalline principle, soluble in alcohol, ether, and boiling water. It is present to the extent of from 7 to 20 per cent., and has formula $C_{15}H_{14}O_6,4H_2O$. A peculiar non-glucosidal form of tannin is also present and is known as *catechu-tannic acid* (30 to 50 per cent.). *Quercetin* and a peculiar (to gambir) *fluorescent principle* are also described.

Uses, etc.—Tonic and astringent. Largely made use of in tanning and dyeing. *Dose.*—5 to 15 grains.

B.P. Preparations.

Pulvis Catechu Compositus - - 1 part in $2\frac{1}{2}$.
Tinctura „ „ - - 1 „ 5 of 60 per cent. alcohol.
Trochiscus Catechu, 1 grain in each lozenge.

B.P.C. Preparation.—Mistura Hæmatoxyli cum Catechu.

LACTUCARIUM.—Lactucarium.—The inspissated, bitter, milky juice contained in the laticiferous vessels of the leaves and stems of Lactuca virosa, *Linn*, obtained by incision.

N.O.—Compositæ.

Syn.—Lettuce Opium.

Habitat.—Great Britain; cultivated.

Characters.—In sections of plano-convex circular cakes, or in irregular angular pieces; externally, greyish-brown or dull reddish-brown; internally, whitish or yellowish, of a waxy lustre; odour heavy, somewhat narcotic; taste bitter.

It is partly soluble in alcohol and in ether. When treated with water it yields a turbid mixture, and when boiled with water it softens and yields a brownish-coloured liquid, which is not coloured blue by iodine test solution.

Chemistry.—Lactucerin (*lactucone*), 50 to 60 per cent., colourless and tasteless, insoluble in water, soluble in alcohol and in ether; *lactucin*, crystalline, bitter, soluble in 60 parts of cold water; *lactucic acid*, bright-yellow, amorphous, coloured red by alkalies, precipitated by lead acetate; *lactucopicrin*, soluble in alcohol, not precipitated by lead acetate solution. The drug contains no hyoscyamine.

Uses, etc.—As reputed sedative and hypnotic. *Dose.*—2 to 5 grains. Official in the B.P.C. and U.S.P., for the preparation of a tincture, the former also includes Syrupus Lactucarii.

Note.—French Lactucarium (*Thridace*) is an extract of Lactuca capitata.

GUTTA-PERCHA.—Gutta-Percha.—The concrete juice of Palaquium oblongifolium, *Burck*, and of other species of Palaquium.

N.O.—Sapotaceæ.

Habitat.—Sumatra and Malay Archipelago generally.

Characters.—In pieces of a dark-brown or chocolate colour, tough, somewhat flexible or in shreds, externally pale; plastic above 120° F. (48·8° C.), Insoluble in water, cold alcohol, alkaline solutions or dilute acids; but almost entirely soluble in chloroform, and entirely so in oil of turpentine, carbon disulphide, or benzol.

Note.—Its collection by the Malays is effected by felling the trees immediately after the rainy season. The branches are removed and the bark cut away in strips, a vessel being placed below each incision to catch the laticiferous exudation. The milky juice rapidly condenses and assumes colours which vary according to the amount of admixture of fragments of bark and other foreign matters. The mass is finally boiled with water. Gutta is now prepared to some extent by extracting the leaves and twigs of the tree with a volatile solvent.

Chemistry.—Gutta-percha consists essentially of *gutta*, a hydrocarbon, ($C_{20}H_{32}$), with varying quantities of the resins *alban* ($C_{20}H_{32}O$) and *fluavil* ($C_{20}H_{32}O_2$), which are soluble in hot alcohol and are probably oxidation products of the first named body.

Uses, etc.—On account of its plasticity, firmness, and impenetrability by water and alcohol, gutta-percha (plain or vulcanized) fills many useful purposes in the arts. In medicine it is used as a protective agent for wounds, and for making mechanical bougies, pessaries, etc.; formerly official for the production of liquor, a solution in chloroform, now included in the B.P.C.

Note.—*Balata* (Chicle) is the concrete juice of the *Bully tree* (SAPOTA MULLIERI, MIMUSOPS KANKI), imported into England from Dutch Guiana; it much resembles gutta-percha, and is the basis of American chewing gum. *Traumaticine* is a solution of gutta-percha tissue in chloroform, and is used for medicated applications.

MONESIA. Monesia.—An extract from various parts of the plant Chrysophyllum glycypœum, *Casaretti*.

N.O.—Sapotaceæ.

Habitat.—South America.

Characters.—In cakes of rather more than one pound in weight, from three-quarters to one inch in thickness, of dark brownish-black colour, very brittle and of a fracture neither dull nor lustrous; taste at first sweet, then astringent, finally acrid; entirely soluble in water.

Chemistry.—*Monesia-tannic acid*, *monesin* (identical with saponin), *lucumin*, glycyrrhizin, fat, etc.

Uses, etc.—Stomachic, mild astringent and for outward application.

CURARA.—Curare.—The inspissated juices, mixed with other substances of the bark of Strychnos Castelnœana, S. toxifera, and of other plants.

N.O.—Loganiaceæ.

Syn.—Woorare, etc.

Habitat.—Brazil and Guiana.

Characters.—Brownish-black, brittle, extractiform, almost entirely soluble in water, sparingly soluble in alcohol.

Note.—Curare is an arrow-poison and varies much in strength. Three or more varieties are made, *e.g.*, *gourd-curare*, *stick-curare*, *pot-curare*, a different species of Strychnos being probably used in each case. The method of preparation consists in making a decoction or infusion and evaporating to dryness. In addition to the various species of Strychnos the plants COCCULUS TOXIFERUS, MALOUETIA NITIDA (*Gua. hamaca*) are said to enter into its composition.

Chemistry.—*Curarine* $C_{18}H_{35}N$ (a crystalline poisonous alkaloid), *curine* an alkaloid, crystalline, non-poisonous; resin, gums, etc.

Uses, etc.—As nervous sedative in tetanus, etc. *Dose.*—$\frac{1}{12}$ to $\frac{1}{2}$ grain. But little toxic when swallowed; highly poisonous when injected into the blood.

CAOUTCHOUC.—India-rubber.—The prepared milk-juice of Hevea brasiliensis, *Muell. Arg.*, and probably other species [*Collins's Report on Caoutchouc*, plate 1]; known in commerce as pure Para rubber.

N.O.—Euphorbiaceæ

Syns.—Elastica, Seringa, Hevé.

Habitat.—Brazil.

B.P. Characters.—In elastic masses of varying thickness, brownish-black externally and mottled with a pale tint internally; insoluble in *water*, ethylic alcohol, alkaline solutions, or dilute acids, soluble in *chloroform*, *oil of turpentine*, *carbon bisulphide*, *benzol*, and *petroleum spirit*. When heated to about 257° F. (125° C.) it melts, remaining soft and adhesive after cooling. Odour characteristic, somewhat empyreumatic; nearly tasteless. When pure it floats on water. S.G. about 0·925.

Caoutchouc is the coagulated and dried latex yielded by anastosmosing vessels (laticiferous) in various species belonging to the orders Euphorbiaceæ, Apocynaceæ, Asclepiadaceæ, Artocarpaceæ, Compositæ, etc. In varying degrees of purity and of commercial value it is yielded by a large number of trees, and while the great bulk of the rubber of commerce is still obtained from the forests of Brazil and of the Congo, plantation rubber from Ceylon and the Malay peninsula is an increasing factor in the supply. The geographical and botanical sources of rubber are roughly as follow:—

1. *America.*—Para rubber, which is official, is yielded by Hevea brasiliensis, H. guianensis, H. paucifolia, etc., while Maranham, Pernambuco, Ceara, and other rubbers are obtained not only from Heveas but also from other trees including Castilloa elastica, Hancornia speciosa, Sapium biglandulosum, Calotropis procera, Ficus species, etc. In Mexico, rubber is obtained by mechanical or chemical processes from the Guayule shrub, Parthenium argentatum, *A. Gray.*—(*N.O.*—Compositæ).

2. *Asia.*—A considerable amount of wild rubber is prepared in the Malay peninsula, Assam, etc., from Ficus elastica and other Ficus species. In Ceylon and also in the Federated Malay States rubber planting, mainly of Castilloa elastica and Hevea brasiliensis has steadily proceeded for some time, and large areas of trees have now reached the producing stage. The rubber is of good quality and is as highly esteemed as Para.

3. *Africa.*—African rubbers are of extremely varying qualities, some varieties containing as much as 60 to 80 per cent. of resin. West Coast and Congo rubber is mainly derived from Landolphia, Funtumia and Ficus species. Madagascar rubber is attributed to Vahea, Willughbeia and Ficus species.

The methods of tapping, coagulation and drying vary in the different regions where the latex is collected; in general, the bark is incised with a special knife and the latex collected in tin cups applied to the base of the incision. When a sufficient quantity of the latex is obtained, it is coagulated by exposure to the action of smoke from a fire of certain materials (nuts, etc.) calculated to afford an acid smoke.

Chemistry.—Pure caoutchouc consists of one or more hydrocarbons (carbon, 87·27; hydrogen, 12·73) and a small percentage, usually not more than 1 or 2 per cent., of a resinous substance soluble in alcohol. On dry distillation caoutchouc

yields certain hydrocarbons, viz., *isoprene*, C_5H_8, *caoutchene*, *caoutchin*, etc.

Uses, etc.—For purposes similar to those described under Gutta-percha. When heated with about one-tenth of its weight of sulphur it becomes vulcanised, and is no longer soluble in the liquids which dissolve it in its natural condition. Vulcanite or ebonite is a super-sulphurated caoutchouc.

B.P. Preparation.

Liquor Caoutchouc - - - - - 1 part in 20.

Used in preparing Charta Sinapis.

MORI SUCCUS.—Mulberry Juice.—The juice of the ripe fruit of Morus nigra, *Linn.*

N.O.—Moraceæ.

Habitat.—Northern Asia Minor and Europe; grown also in Britain.

Characters.—Of a dark violet or purple colour, with a faint odour and a refreshing, acidulous, saccharine taste. S.G. about 1·060.

Chemistry.—Sugar, citrates, malates, etc.

Uses, etc.—Refrigerant and flavouring agent.

ALOE BARBADENSIS.—Barbados Aloes.—The juice that flows from the transversely cut leaves of Aloe vera, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 282], Aloe chinensis, *Bak.* [*Bot. Mag.* plate 6301], and probably other species, evaporated to dryness. Imported from the West Indian Islands, and known in commerce as Barbados and Curaçao Aloes.

N.O.—Liliaceæ.

Habitat.—West Indies (Curaçao, etc.).

Note.—Little Aloes now comes from Barbados, and the term Curaçao Aloes is now more correctly applied to this variety.

B.P. Characters and Tests.—In hard masses varying in colour from yellowish or reddish-brown to chocolate-brown or almost black. Fracture either dull and waxy, in which case the splinters are opaque; or smooth and glassy, in which case the splinters are transparent; the opaque variety examined under the microscope exhibits numerous minute crystals embedded in a transparent mass. Odour disagreeable, taste nauseous and bitter. The powder imparts a crimson colour to *nitric acid*, and when treated with *sulphuric acid* and the vapour of *nitric acid* should yield only a slight bluish-green, but not a bright blue colour (absence of Natal Aloes). Barbados Aloes is almost entirely soluble in *alcohol* (90 per cent.) diluted with half its volume of *water*. Not more than 30 per cent. should be insoluble in cold *water*.

Note.—The leaf of the Aloe plant is succulent, and the pericyclic cells of the vascular bundles contain a juice, which, when thickened by solar or artificial heat, constitutes Aloes. Barbados Aloes is usually of the "hepatic" or "livery" type, thin splinters being opaque or translucent and not glassy as in Cape Aloes. This hepatic appearance is due to crystallisation of aloin which is favoured by slow concentration. Barbados Aloes is sometimes glassy and is thus known as "Capey," such a product is commercially less valuable. Gourd Aloes is now seldom met with, the concentrated juice being run into spirit cases and so exported.

Chemistry.—*Aloin* (20 to 25 per cent.), *emodin*, a trace of volatile oil, resin, and ash. The aloins present in Barbados Aloes are distinguished by the names *barbaloin* and *isobarbaloin*, and by giving with cold nitric acid a rapidly fading vivid crimson colour. The medicinal activity of Barbados Aloes is probably shared by the aloin and emodin (trioxymethylanthraquinone) it contains. The resin present is a compound ester of *aloeresinotannol* and cinnamic acid, it is not soluble in water and hence is absent from the official extract.

Uses, etc.—As purgative, usually given in combination with other medicines. *Dose.*—2 to 5 grains.

B.P. Preparations.

Aloin. [per cent.

*Extractum Aloes Barbadensis, aqueous; yield about 75

Pilula Aloes Barbadensis - - 1 part in 2, nearly.

,, ,, et Ferri - - - 1 ,, $4\frac{1}{2}$.

,, Cambogiæ Composita.

† ,, Colocynthidis Composita.

**Used in preparing*

Decoctum Aloes Compositum - - - 1 part in 100.

Extractum Colocynthidis Compositum - 1 ,, 2.

Tinctura Aloes, 1 part in 40 of alcohol (45 per cent.).

†*Used in*

Pilula Colocynthidis et Hyoscyami, 2 parts in 3.

B.P.C. Preparations.—Tinctura Aloes Composita, Tinctura Myrrhæ Composita and many others.

ALOE SOCOTRINA.—Socotrine Aloes.—

The juice that flows from the transversely cut leaves of Aloe Perryi, *Baker* [*Bot. Mag.* plate 6596], and probably other species of Aloe, evaporated to dryness. Imported principally by way of Bombay, and known in commerce as Socotrine and Zanzibar Aloes.

N.O.—Liliaceæ.

Syn.—Hepatic Aloes.

Habitat.—East Coast of Africa, Socotra, etc.

B.P. Characters and Tests.—Socotrine Aloes, as imported, is usually more or less viscid and brownish-yellow, but forms, when dried, hard dark-brown, or nearly black masses which break with a dull and waxy, uneven fracture. Odour strong but not disagreeable, taste nauseous and bitter.

Zanzibar Aloes is usually imported in liver-brown masses. Fracture dull and waxy, but nearly smooth and even. It has a characteristic odour and a nauseous and bitter taste.

Both varieties are opaque even in small splinters, exhibit when examined under the microscope numerous minute crystals embedded in a transparent mass, and impart to *nitric acid* a reddish or yellowish-brown colour. If the vapour of *nitric acid* is blown over the powder previously mixed with *sulphuric acid*, no blue coloration is produced (absence of Barbados and Natal Aloes).

Socotrine and Zanzibar Aloes are almost entirely soluble in *alcohol* (90 per cent.) diluted with half its volume of *water*; and about 50 per cent. should be soluble in *water*.

Note.—Socotrine aloes is said to be prepared by natural inspissation (*i.e.*, by exposure to the air). It is imported either in monkey skins (Zanzibar Aloes), or in kegs, boxes, or tins, and frequently in a semi-solid condition.

Chemistry.—Aloin (sometimes distinguished as *socaloin*, but recently claimed to be identical with barbaloin), resin, volatile oil (traces), ash, etc. Socotrine Aloes usually contains more insoluble resinous matter than the Barbados variety.

Uses, etc.—As purgative, etc. Not so powerful in action as Barbados Aloes. *Dose.*—2 to 5 grains.

B.P. Preparations.

Aloin.

Pilula Aloes et Asafetidæ	- -	1 part in 4.
,, ,, Myrrhæ	- - -	1 ,, $2\frac{1}{4}$.
,, ,, Socotrinæ	- - -	1 ,, 2, nearly.
,, Rhei Composita.		
Tinctura Benzoini Composita.		

B.P.C. Preparations.—Extractum Aloes Socotrinæ, Pulvis Aloes et Canellæ, Tinctura Aloes et Myrrhæ, etc.

Aloinum, P.B., $C_{16}H_{16}O_7,3H_2O$, is a yellow, inodorous, crystalline substance, extracted from aloes by solvents, and purified by recrystallisation. As obtained from the different varieties of aloes the products differ slightly, but their medicinal properties are similar. Aloin is freely soluble in hot water and in hot alcohol; little soluble in cold alcohol, less so in cold water, and insoluble in ether. It is not readily altered in acidified or neutral solutions, but rapidly in alkaline fluids. The varieties of aloin are termed according to the particular variety of aloes from which they are prepared; they are *barbaloin, socaloin, nataloin* and *capaloin*. Their chemical resemblances and differences are as yet, however, by no means fully worked out, it being held by some that all aloins yet described, except nataloin, are identical with barbaloin and isobarbaloin.

Barbaloin, $C_{16}H_{16}O_7$, from Barbados and Curaçao Aloes, is the aloin of commerce; it yields, on oxidation, *aloetic, chrysammic*, oxalic and picric acids. It gives a red colour with fuming nitric acid, and under the action of reducing agents, yields anthracene. Isobarbaloin is a constituent of Curaçao Aloes and probably of commercial aloin.

Socaloin, $C_{16}H_{16}O_7$, from Socotrine and Zanzibar Aloes gives a red coloration with hot or fuming nitric acid. According to *Leger*, socaloin and barbaloin are chemically alike, but it should be noted that the formula for socaloin has recently been stated as $C_{34}H_{38}O_{15}$.

Nataloin, $C_{25}H_{28}O_{11}$, from Natal Aloes only, yields on oxidation, picric and oxalic acids and, like barbaloin, gives a red colour with cold nitric acid; it may be distinguished from the latter, however, by giving a blue colour when moistened with sulphuric acid and brought into contact with the fumes of nitric acid.

Capaloin is identical with barbaloin but contains no isobarbaloin.

Note.—Aloe purificata, U.S.P., is obtained by melting Socotrine or Barbados Aloes, liquefying by the addition of alcohol, straining and evaporating.

ALOE CAPENSIS.—Cape Aloes.—The inspissated juice of the leaves of Aloe ferox, *Miller*, and of A. spicata, *Linn.*

N.O.—Liliaceæ.

Habitat.—South Africa.

Characters, Chemistry, etc.—In dark greenish-brown (almost black) brittle lumps of irregular form, breaking with a glassy or conchoidal fracture; thin splinters, when viewed by transmitted light are seen to be of amber colour and transparent. The powder is of a pale, greenish-brown colour. Odour strong and peculiar, more like that of Socotrine than Barbados Aloes, but readily distinguishable from either, contains Capaloin (*vide supra*). The resin is a compound of *aloeresinotannol* with *paracumaric acid*.

Uses, etc.—Similar to the official kinds; included in many of the Continental Pharmacopœias. *Dose.*—2 to 5 grains.

Natal Aloes is a variety imported from Natal; it differs in appearance from ordinary Cape Aloes in being opaque and thus having "Hepatic" characters. It contains a distinctly crystalline principle (*see* Nataloin *above*), and is probably derived from Aloe succotrina. Natal Aloes is no longer of commercial importance.

Jafferabad Aloes, supposed to be the same as *Mocha Aloes*, is of a black pitch-like colour, and a glassy, somewhat porous fracture; it is the product of A. abyssinica, and is imported from Arabia.

Musambra Aloes is made in India from Aloe vulgaris.

Cabaline Aloes (Horse Aloes) was the name formerly applied to an inferior dark-coloured, disagreeable-smelling aloes, largely used for veterinary purposes.

Uganda Aloes, in some respects, resembles the Cape product but is opaque and not vitreous, it contains about 6 per cent. of an aloin said to be identical in composition with barbaloin.

2. GUMS.

The Gums made use of in medicine are vegetable carbohydrates, insoluble in alcohol and ether, but soluble in, or swelling when treated with water. They are usually spontaneously exuded from the bark of the trees which yield them, and frequently owe their origin to the degradation of the cellular tissues of the plant known as "gummosis." They are in most cases capable of conversion into sugars by treatment with dilute acids, and into oxalic and mucic acids when acted upon by oxidising agents.

ACACIÆ GUMMI.—Gum Acacia.—A gummy exudation from the stem and branches of Acacia Senegal, *Willd.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 94], and of other species of Acacia, *Willd.*

N.O.—Leguminosæ.

Syn.—Gum Arabic.

Habitat.—Kordofan and North Africa.

B.P. Characters and Tests.—In rounded or ovoid tears, or masses, of various sizes; or in more or less angular fragments with glistening surfaces; nearly colourless, often with a yellowish tint. The tears are opaque from numerous minute external fissures, and very brittle; the fractured surfaces are vitreous in appearance. Taste bland and mucilaginous; nearly inodorous; insoluble in *alcohol* (90 per cent.), but entirely soluble in *water*, forming a translucent viscid solution which feebly reddens *litmus*. When dissolved in an equal weight of *water*, the solution should neither form a glairy mucilage nor, after admixture with more *water*, should it yield a gummy deposit on standing. The aqueous solution forms with *solution of lead subacetate* an opaque, and with *solution of borax* a more or less translucent, white jelly; it gives no precipitate with *solution of lead acetate;* is not coloured blue or brown by a small quantity of *solution of iodine* (absence of starch or of ordinary "dextrin" of commerce) nor bluish-black by *test-solution of ferric chloride* (absence of tannic acid); and does not give a red precipitate when boiled with *solution of potassio-cupric tartrate* (absence of certain sugars). Gum acacia should not yield more than 4 per cent. of ash.

Varieties and Substitutions:—

Kordofan or *Hashabi Gum* (the official variety) is the finest of the Turkey or Egyptian gums, so-called because exported from Alexandria and other Egyptian ports, and usually assorted in the Mediterranean; gums which come into commerce slightly inferior to it in value are the *Senegal* and *Suakim* or *Talca gums*. These gums are mostly assorted at Trieste where qualities varying from "first picked" to "sorts" are graded,

"sorts" being the refuse gum after better qualities have been picked out. Egyptian gum became very scarce during the Soudan trouble and was largely replaced by the Senegal variety, it is now however as abundant as formerly.

Morocco, Mogadore or *Brown Barbary Gum*, from ACACIA GUMMIFERA, A. ARABICA, or A. NILOTICA, resembles Kordofan gum in appearance.

East Indian Gum (*Amrad* or *Babool*, etc., A. ARABICA et species variæ). Principally imported from Bombay, although the product of Eastern Africa. Varies in appearance, and is frequently a mixture of different gums. The fruit of Acacia arabica (*Babul pods*) is used for preparing the drug known as *Akakia*, an extract sold in the form of bladders and cakes in the bazaars of India and also sometimes met with in this country.

Cape Gums (A. HORRIDA). An amber-brown coloured inferior gum.

Australian or *Wattle Gum* (A. PYCNANTHA, A. DEALBATA, A. HOMALOPHYLLA, etc.). Found in large tears or masses of a dark yellow or red-brown colour, transparent, nearly free from cracks, readily soluble in water, very adhesive. Sometimes contains a little tannic acid.

Ghatti Gum is a variety imported from India and Ceylon, yielded by ANOGEISSUS LATIFOLIA (*N.O.*—Combretaceæ) and is recognised by the Indian and Colonial Addendum as a substitute for Acacia, it is superior in adhesive power and viscosity to gum arabic, and gives a less copious precipitate with basic acetate of lead than the latter.

Note.—Many of the inferior gums are not entirely soluble in water and yield ropy mucilages, such varieties are excluded by the official description.

Chemistry.—Pure gum arabic consists of the *calcium, potassium* and *magnesium salts* of *gummic* or *arabic acid* ($C_{12}H_{22}O_{11}$), with moisture and a trace of sugar. The calcium salt which forms the greater part of the gum is known as *arabin*. *Arabic acid* may be separated from its salts by acidifying a solution of gum in water. By treating gum with diluted sulphuric acid *arabin sugar* or *arabinose* is produced; this reduces Fehling's solution. By prolonged heating, gum becomes converted into *metarabic acid* identical with the *cerasin* of cherry gum. Gum Acacia yields from 2·7 to 3·5 per cent. of mineral matter.

Uses, etc.—Besides being largely used in the arts, gum acacia is useful in medicine as a demulcent, and for emulsifying, etc.

B.P. Preparations.

*Mucilago Acaciæ - - - - - 4 parts in $8\frac{3}{4}$.
Pilula Ferri.
,, Phosphori.
†Pulvis Amygdalæ Compositus.
,, Tragacanthæ Compositus.
Trochisci, all.

**Used in preparing*
Mistura Olei Ricini and all Trochisci.

†*Used in preparing*
Mistura Amygdalæ.

B.P.C. Preparations.—Mistura Acaciæ, Pulvis Acaciæ Compositus, Syrupus Acaciæ.

TRAGACANTHA.—Tragacanth.—A gummy exudation obtained by incision from Astragalus gummifer, *Labill.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 73], and some other species of Astragalus, *Linn.* Known in commerce as Syrian tragacanth.

N.O.—Leguminosæ.

Syn.—Gomme Adragante; Gum Dragon.

Habitat.—Asia Minor.

B.P. Characters and Test.—White or pale yellowish-white flattened flakes, of varying length and breadth; frequently about one inch (two and a half centimetres) long and half an inch (twelve millimetres) wide; thin, irregularly oblong or more or less curved, and marked on the surface by concentric ridges. They are somewhat translucent, horny, break with a short fracture, and are inodorous and almost tasteless. Tragacanth is sparingly soluble in *water*, but swells into a gelatinous mass, which may be tinged violet or blue by *solution of iodine*.

Varieties.—Three varieties have been described, viz., the official *flake* or *leaf tragacanth, vermiform tragacanth,* consisting of coiled and contorted string-like pieces and *common tragacanth, small tragacanth* or *sorts* which occurs in variously shaped tear-like pieces more or less brown in colour.

Note.—Tragacanth is regarded not as a secretion of the plant, but as a degradation product produced by the transformation of the cells of the pith and neighbouring medullary rays, it is eventually exuded under pressure. The shape of the individual pieces of gum is regulated by the shape of the orifice through which it has exuded, the ribbons or flakes through slits and the vermiform or tear gum through round holes.

Chemistry.—Tragacanth contains two gums, the one, *bassorin* or *tragacanthin* (40 to 60 per cent.), insoluble, but swelling in water, the other an arabin-like gum soluble in water, but unlike arabin, yielding no precipitate with borax. All varieties of tragacanth contain more or less marked traces of starch.

Uses, etc.—As demulcent; yields a highly tenacious mucilage valuable for suspending insoluble powders in liquids. *Dose.*—10 to 20 grains.

B.P. Preparations.

Confectio Sulphuris.
Glycerinum Tragacanthæ.
Mucilago Tragacanthæ - - - - - 60 grains to 10 [fluid ounces.
Mistura Cretæ.
,, Guaiaci.
Pilula Ferri.
,, Quininæ Sulphatis.
Pulvis Opii Compositus.
,, Tragacanthæ Compositus - - 1 part in 6.

Note.—Adulterations, Substitutions and Allied Gums.—*Bassora, Moussel* (*Hog gum*) and *Caramania gums,* or allied gums, are dark-coloured varieties imported from Persia, never in flakes, and are faced with white lead. This injurious fraud is detected by applying the usual tests for lead salts to a solution in diluted nitric acid. Bassora gum consists of bassorin (insoluble) and arabin (soluble). *Cherry gum,* from cherry and plum trees, is a partially soluble gum. An East African gum, resembling tragacanth, and said to be obtained from a species of Sterculia, has been described. It occurs in flat pieces or in tears, and consists largely of bassorin.

3. RESINS.—RESINÆ.

These are solid or semi-solid secretions or excretions of plants usually existing in the latter as oleo-resinous juices or emulsions, and frequently occurring either as natural exudations, or in other instances obtained by incision from the trunks of the trees which yield them. They often contain traces of the volatile oils with which they are associated in their natural condition. Resins are insoluble in water, but generally soluble in alcohol, ether, volatile oils, and some (resin-acids) in alkalies yielding resin soaps.

Chemically resins may be divided into three groups (Tschirch) according to constitution.

(*a*). A group containing esters of resin alcohols known as resino-tannols, this group includes the benzoic and cinnamic esters of Benzoin, Tolu, etc., and the resins of the Umbelliferous gum-resins.

(*b*). Resenes or indifferent resins possessing neither acid nor ethereal properties—such are the resins of mastic, olibanum, elemi, etc.

(*c*). Terpino-resins, a group containing free resin-acids, *e.g.*, colophony.

LABDANUM.—Labdanum.—A resinous exudation from various species of Cistus.

N.O.—Cistaceæ.

Syn.—Labdanum.

Habitat.—Coasts of the Mediterranean.

Characters.—In dark-brown, soft, glutinous masses, or in hard, cylindrical, contorted or spiral pieces. The former variety is the purest, but it is seldom met with; that usually found in commerce being the harder and less pure variety known as common or roll labdanum.

Chemistry.—Resin, volatile oil, wax, extractive matter, etc.

Uses, etc.—Now obsolete, formerly much prized for its aromatic and stimulant properties.

COPAL.—Copal.—The concrete recently exuded or fossil juice of various trees. The most important variety is the Zanzibar copal from Trachylobium Hornemannianum, *Hayne* (*N.O.*—Leguminosæ). Other varieties are South American Copal from Hymenæa Courbaril, *Linn.* and other species; and West African Copal from Copaifera Guibourtiana, *Benth.*

Syn.—Gum Animi, Animi Resin.

Habitat.—Africa, Brazil, West Indies, etc.

Characters.—Varying much according to source; generally in roundish, irregular, or flattish pieces, often rough on the surface; colourless, yellowish or brownish-yellow, more or less transparent; hard, with a shining

conchoidal fracture; inodorous and tasteless; of a S.G. 1·045 to 1·139; insoluble in alcohol; partially soluble in ether and in oil of turpentine. When heated it undergoes a chemical change, gives off gases and becomes readily soluble in the two latter-named solvents.

Chemistry.—*Trachylolic Acid* (80 per cent.), *isotrachyloic acid* (4 per cent.), *resenes* (6 per cent.) with a small quantity of volatile oil and bitter principle.

Uses, etc.—In varnish making.

GUAIACI RESINA.—Guaiacum Resin.—

The resin obtained from the stem of Guaiacum officinale, *Linn.*, or of Guaiacum sanctum, *Linn.*

N.O.—Zygophyllaceæ.

Habitat.—West Indies, South America and the Bahamas.

B.P. Characters and Tests.—Usually in large masses but sometimes in more or less rounded tears. It is brittle, breaking with a clean glassy fracture; thin splinters are transparent, and vary in colour from yellowish-green to reddish-brown. The powder is greyish, but by exposure to light and air becomes green. When warmed the odour is somewhat balsamic, the taste slightly acrid. A solution in *alcohol* (90 per cent.) assumes a blue colour on the addition of diluted *test-solution of ferric chloride.*

Note.—The resin is obtained from the living tree either as a natural exudation or as the result of incisions, or from logs by the application of heat. The method of obtaining the resin by heat is to take convenient lengths of the wood and bore a hole through the centre in the direction of its length by means of an augur; one end is then placed in a fire and at the other is presented a vessel to receive the molten resin which runs through the hole as the wood burns. Another method sometimes adopted is that of boiling the logs in strong salt water. A saturated brine solution may be serviceable in two ways; first, its boiling point would be about 106·6° C., and, second, such a solution is less likely than water alone to dissolve out and so remove any of the constituents of the resin.

A tincture of the resin produces a blue colour when applied to the surface of a recently pared potato, this test depends on the action which the guaiaconic acid (*vide infra*) in alcoholic solution has on the gluten contained in the tuber. This nitrogenous constituent is found in greatest quantity near the "eyes" or buds. The resin is useful as a test for the presence of blood, with the red colouring matter of which, in the presence of ozonic ether, it produces a blue colour. Guaiacum resin is soluble in acetone, methylic, ethylic and amylic alcohols, chloroform, creasote, caustic alkaline solutions, sal volatile and oil of cloves. It is also partially soluble in bisulphide of carbon and benzol and insoluble in hot turpentine.

Chemistry.—*Guaiaconic acid* (70 per cent., amorphous), *guaiaretic acid* (crystalline), *guaiac beta-resin*, gum, *guaiacic acid*, *guaiac-yellow*. On destructive distillation the resin yields *guaiacene*, *guaiacol*, *creosol* and *pyroguaiacin*.

Uses, etc.—Stimulant, diaphoretic; employed in rheumatism.
Dose.—5 to 15 grains.

B.P. Preparations.

Mistura Guaiaci - - - - -	1 part in 40.
Pilula Hydrargyri Subchloridi Composita -	1 ,, 2¼.
Tinctura Guaiaci Ammoniata - - -	1 ,, 5.
Trochiscus Guaiaci - - - -	3 grains in each.

B.P.C. Preparations.—Confectio Guaiaci Comp., Tinctura Guaiaci.

MASTICHE.—**Mastich.**—A concrete resinous exudation obtained by making incisions in the bark of the stem and large branches of Pistacia Lentiscus, *Linn.*

N.O.—Anacardiaceæ.

Habitat.—Island of Scio.

Characters.—In rounded, irregular, oblong, or pear-shaped tears, of a pale yellow colour, and either opaque and dusty on their outer surface, or far more frequently having a glassy and transparent appearance; brittle and breaking with a vitreous, conchoidal, pale-yellow fracture. Odour agreeable, somewhat balsamic and terebinthinous; taste mild and resinous. Becoming plastic when chewed; entirely soluble in ether.

Note.—The incisions are made vertically—a healthy plant yielding from ten to twelve pounds.

Chemistry.—A minute quantity of volatile oil; resin acids (*masticonic, masticinic* and *masticolic* acids), which are soluble in alcohol (90 per cent.); resenes *masticin* (10 per cent.), insoluble in alcohol, and another (30 per cent.) soluble in alcohol. S.G. 1·095. Mastic is soluble in half its volume of ether and of chloroform.

Uses.—Internally, rarely; occurs in Pil. Aloes et Mastiches and Tinct. Ammon. Co., also in Mastiche et Chloroformum B.P.C., the latter being used in dentistry. Mastic also obtains use as an ingredient in varnishes and cements. Official in the U.S.P.

Adulterations.

(1). Gum Juniper or Sandarac, a product of the coniferous plant Callitris quadrivalvis (*see below*). It does not become plastic when chewed, and the tears are more elongated.

(2). Olibanum (*which see*).

(3). Pseudo-mastich, an exudation from Atractylis gummifera, occurs in oblong and thick agglutinated tears, and is insoluble in alcohol.

(4). Bombay Mastic, from P. Khinjuk or P. Mutica, is darker and less agreeable in odour.

BENZOINUM.—**Benzoin.**—A balsamic resin obtained from Styrax Benzoin, *Dryand.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 159]; and probably from other species of Styrax, *Linn.* Known in commerce as Siam and Sumatra benzoin.

N.O.—Styraceæ.

Syn.—Gum-Benjamin; Benzoe.

Habitat.—Siam and Sumatra.

B.P. Characters.—In flat or curved tears varying in size, but seldom exceeding two inches (five centimetres) in length and half an inch (twelve millimetres) in thickness, yellowish or reddish-brown externally, milky white internally; or in masses composed of tears more or less closely agglutinated by a reddish-brown translucent, or greyish-brown opaque, resinous intervening substance. It is brittle but softens readily when warmed, and when further heated yields fumes of benzoic acid. It has an agreeable odour, recalling that of vanilla in the case of Siam benzoin, and of storax in the case of Sumatra benzoin. It is almost entirely soluble in *alcohol* (90 per cent.) and in *solution of potassium hydroxide.*

VARIETIES.—*Sumatra benzoin* occurs in large rectangular blocks, marked with the impression of a mat and covered with a white cotton cloth. When broken, few, but large, white tears are to be seen in it; it is generally made up of brown resiniform matter of a darker colour than the above, with small pieces or chips intermixed, which give it a granite-like appearance. Its odour is weaker and less agreeable than that of the Siam variety. It is erroneously called a "gum."

Siam benzoin is the finest variety, and is derived from an unknown species of Styrax. It occurs in tears or masses of loosely-agglutinated tears of a yellow-reddish or brown colour externally, and translucent, milk-white or almond-like internally. It is never enveloped in calico. This variety may occur in lumps of a brownish colour, which when broken, present an amygdaloid appearance from the white tears imbedded in the mass. It contains more benzoic acid than the Sumatra variety, this amounting sometimes to as much as 40 per cent., and a much larger proportion of the benzoic acid in this variety exists in the combined state; cinnamic acid is usually absent.

Penang benzoin resembles the Sumatra variety, being produced in the same locality, but has a storax-like odour; it is said to be derived from species other than S. BENZOIN, as also is the similar and equally less valuable *Palembang* benzoin, which contains no cinnamic acid.

Note.—Incisions are made in the tree when it is seven years old. Each tree in Sumatra yields about three pounds annually for a period of ten to twelve years. The finest, which is the product of the first three years, is called *head benzoin*, the subsequent runnings yield the *belly*, and when the tree is cut down and resin removed by scraping this constitutes the *foot*, and is very inferior.

Chemistry.—Benzoic acid (12 to 20 per cent. in Sumatra variety) in all the varieties, free and combined; *cinnamic acid* in Sumatra benzoin, several resins, *vanillin*, and in all, traces of *volatile oil*. On destructive distillation styrol and pyrocatechin are obtained. Cinnamic acid may be detected by treating the drug with soda solution, filtering and boiling the filtrate with potassium permanganate, when the odour of bitter almonds is produced. The resins present in Siam benzoin are known as *benzoresinol* and *siaresinotannol;* in the Sumatra variety benzoresinol and *suma-resinotannol* are found. All these resins are of an alcoholic character, and exist in combination with part of the benzoic acid present. The Siam variety contains a larger proportion of vanillin than that of Sumatra.

Uses, etc.—Stimulant expectorant and antiseptic; externally a styptic. When added to fats retards their oxidation, and hence prevents rancidity.

B.P. Preparations.

*Acidum Benzoicum.		
†Adeps Benzoatus - . -	1 part in 33, nearly.	
Tinctura Benzoini Composita -	1 „	10 of alcohol (90 per cent.)
Unguentum Cetacei - - -	1 „	50.

**Used in the preparaton of*
Ammonii Benzoas, Sodii Benzoas, Tinctura Camphoræ Composita, Tinctura Opii Ammoniata, Trochiscus Acidi Benzoici ($\frac{1}{2}$ grain in each).

†*Used in the preparation of many ointments.*

Note.—A simple tincture of benzoin is included in the B.P.C., which also contains formulæ for Collodium Stypticum and Sevum Benzoatum. The compound tincture is unofficially known as *Friar's Balsam.*

Acidum Benzoicum P.B., C_6H_5COOH, is described by the Pharmacopœia as being obtained from Benzoin by sublimation. It is also permitted to be obtained from toluene, from hippuric acid, and from other organic compounds. It occurs in light feathery crystalline plates and needles, which are flexible, nearly colourless, and odourless when quite pure; but when obtained from benzoin possess an agreeable aromatic odour, due to traces of other substances. It is soluble in 400 parts of cold or 17 parts of boiling water, in its own weight of absolute alcohol, in 3 parts of alcohol (90 per cent.), in 2·5 of ether, in 7 of chloroform, and in the fixed and volatile oils; also in solutions of the alkalies and of calcium hydroxide, forming benzoates, from these solutions it is precipitated on the addition of hydrochloric acid unless the solutions are very dilute. It volatilises in the vapour of water. Pure benzoic acid melts at 250·5° F. (121·4° C.) and boils at 480·2° F. (249° C.); but when obtained from benzoin, it melts at about 248° F. (120° C.), forming a yellowish liquid which becomes brownish but not red as the temperature rises (absence of hippuric acid), and boils at about 462° F. (238·9° C.). When heated to the last-named temperature, it passes off in vapour which burns with a bright-yellow flame, and leaves only a slight residue. When 0·5 gramme is heated in a closed crucible with twice its weight of calcium carbonate, the mass dissolved in diluted nitric acid, and solution of silver nitrate added, only the slightest cloudiness should result (absence of chlorobenzoic acid). It should yield no characteristic reaction with the tests for oxalates. It should not develop the odour of benzaldehyde when warmed with its own weight of potassium permanganate and ten times its weight of diluted sulphuric acid (absence of cinnamic acid) 0·2 grammes suspended in 10 cubic centimetres of water should not immediately discharge the colour of two drops of solution of potassium permanganate (absence of hippuric and cinnamic acids). The bulk of the acid found in commerce is obtained by other means than sublimation or from other sources than benzoin, *e.g.*, (*a*) by treatment of benzoin with lime and subsequent precipitation by an acid, (*b*) from the urine of horses (containing hippuric acid), (*c*) from toluene.

Dose.—5 to 15 grains.

LACCA.—Lac.—A resinous secretion produced on Ficus religiosa, Schleichera trijuga, Butea frondosa, and other trees, by the hemipterous insect, Tachardia Lacca (Coccus Lacca), which lives upon the cell-sap obtained by puncture of the slender twigs.

N.O.—Urticaceæ, Euphorbiaceæ, Leguminosæ, etc.

Habitat.—India.

Characters.—Lac is known in three forms, viz.:—

1. *Stick-lac.*—Consisting of thin twigs, encrusted with a brown-red resin, the surface of which is perforated with numerous minute pores. When chewed it colours the saliva red; largely soluble in alcohol. Stick-lac is the natural state in which lac is collected.

2. *Seed-lac.*—Consisting of minute irregular fragments, broken from the twigs, and partially exhausted by water; usually brighter in colour than stick-lac.

3. *Shell-lac* (*Shellac*).—Consisting of thin translucent fragments of a reddish-yellow colour, insoluble in water, freely soluble in alcohol. This variety is obtained by removing the colouring matter of the crude stick-lac, by washing with water, melting, and rolling into sheets. Orpiment (arsenic sulphide) and resin may be added during the preparation.

Chemistry.—Wax (6 per cent.), pigment (*laccin*), *laccinic acid* (allied to carminic acid, *see* cochineal) and resin. The bulk of the resin (65 per cent.) is insoluble in ether and probably the aleuritic ester of resinotannol. the remainder contains a colouring matter, *erythrolaccin*.

Uses, etc.—Crude lac was formerly occasionally used in medicine; now only for the preparation of varnishes, sealing wax, etc.

Note.—*Lac-dye* consists of the colouring matter of stick-lac, prepared by allowing the wash-liquor obtained in preparing shellac to deposit, the sediment so obtained being pressed into cakes and dried. *Bleached-lac* is shellac deprived of colour by exposure to light and moisture, or more usually by the action of sulphurous acid or chlorine; it becomes insoluble if not kept under water.

Sealing wax.—The best red variety is prepared by mixing together shellac, Venice turpentine, balsam of Peru and cinnabar.

ADULTERATIONS.—Common resin is a frequent constituent of shellac and can only be considered an adulterant when present in excess of 2 to 5 per cent. The determination of the amount of iodine absorbed affords the best method of detecting this addition, pure shellac of commerce should not give a figure higher than 11 per cent.

XANTHORRHŒÆ RESINA.—Xanthorrhœa Resin.

The resinous exudation of Xanthorrhœa species, *Smith*.

N.O.—Liliaceaæ.

Syn.—Botany Bay Resin, Acaroid Resin, Grasstree Gum, Gum Accroides.

Characters.—In yellowish or reddish-yellow brittle masses; opaque, fusible; colour and taste balsamic; insoluble in water, soluble in alcohol.

Chemistry.—The yellow and red varieties differ in composition, the yellow consists mainly of the paracumaric ester of *xanthoresinotannol*; the red acaroid resin, known as black boy resin, being composed of 85 per cent. of the paracumaric ester of *erythroresinotannol*, cinnamic and benzoic acids are also present.

Uses, etc.—Tonic, stimulant. In varnishes as an inferior substitute for shellac. *Dose.*—5 to 20 grains in tincture.

DRACONIS RESINA.—Dragon's Blood.—The resin

obtained from the fruit of Dæmonorops Draco, *Blume* (Calamus D.).

N.O.—Palmaceæ.

Syn.—Sanguis draconis.

Habitat.—Borneo and Sumatra.

Characters.—Occurs in irregular grains, cakes or irregular masses ("lump" and "saucer") and in cylindrical sticks ("reed") which are about twelve inches long, half an inch or more thick, and are wrapped in palm leaves. It is of a dark red-brown colour on the surface, of a brighter red, glossy, and somewhat porous internally, transparent in thin splinters, and breaks with resinous but irregular fracture. It is soluble in alcohol, benzol and chloroform; ether and turpentine dissolve it less freely and petroleum spirit not at all. Inodorous and nearly tasteless.

Chemistry.—The resin (50 to 70 per cent.) is said to consist of a compound of *benzoic* and *benzoyl-acetic acid*, with a peculiar resin called *draco-resinotannol*. *Draconalban* (white, amorphous) and *dracoresin* are also present. The ash should amount to not more than about 9 per cent.

Uses, etc.—As a colouring agent in pharmacy and in the arts.

Note.—The term dragon's blood has also been applied to the resins of DRACŒNA DRACO (Socotra), PTEROCARPUS DRACO (West Indies) and CROTON DRACO.

PIX BURGUNDICA.—Burgundy Pitch.—The resinous exudation obtained from the stem of Picea excelsa, *Link.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 261], melted and strained.

N.O.—Coniferæ.

Syn.—Spruce-fir resin.

Habitat.—Austria and Finland.

B.P. Characters and Test.—Hard and brittle, yet gradually taking the form of the vessel in which it is kept; somewhat opaque, dull reddish-brown or yellowish-brown, fracture clean and conchoidal. Odour aromatic, especially when heated; taste sweet, aromatic, without bitterness. Readily soluble in *glacial acetic acid.*

Chemistry.—*Volatile oil* (small quantity) and resin, consisting chiefly of the aldehyde of *pimaric acid* ($C_{20}H_{30}O_2$). The resin is entirely soluble in 20 parts of rectified spirit, and nearly so in 1½ or 2 parts of glacial acetic acid.

Uses, etc.—Externally in the form of plaster or ointment, as stimulant, and slight rubefacient.

B.P. Preparation.

Emplastrum Picis - - - - 1 part in 2, nearly.

Note.—The term "Burgundy" is now, at any rate, a misnomer, since none is obtained from that province. A fictitious Burgundy pitch is prepared by melting together resin, palm oil, and American turpentine; this is only partially soluble in rectified spirit or glacial acetic acid.

GUMMI JUNIPERI.—Sandarac.—The resin obtained as a spontaneous exudation, or by incisions from Callitris quadrivalvis, *Ventenat* (Thuja articulata).

N.O.—Coniferæ.

Syn.—Gum Juniper.

Habitat.—Mogadore (North Africa).

Characters.—Occurs in brittle, elongated tears, of a pale yellowish colour, with a dusty surface; the fracture is glass-like and transparent. It is almost entirely soluble in alcohol, and becomes pulverulent when masticated.

Chemistry.—Consists of the resin acids, *sandaracinic acid, sandaracinolic acid,* and *sandaracopimaric acid,* together with *sandaracoresene* and a trace of volatile oil.

Uses, etc.—Formerly given internally, and also used in ointments and plasters; its chief application is as a varnish. In the form of powder (*pounce*) it was once much used to dust on fresh manuscripts to prevent the ink from running.

Note.—The term "Juniper Gum" is a misnomer, sandarac being quite distinct from the oleoresinous exudation of Juniperus communis, *q.v.* An Australian sandarac from C. robusta is with difficulty distinguished from the African variety.

RESINA.—Resin.—The residue left after the distillation of the oil of turpentine from the crude oleo-resin (turpentine) of various species of Pinus (chiefly from Pinus australis, P. taeda, P. pinaster, P. palustris and P. laricio).

N.O.—Coniferæ.

Syn.—Colophony Resin, Colophonium.

Habitat.—America.

B.P. Characters and Tests.—Translucent, of a light amber colour, compact, brittle, pulverisable; fracture shining; odour and taste faintly terebinthinate. It is soluble in *alcohol* (90 per cent.), *ether*, *benzol*, and *carbon bisulphide*, is easily fusible, and burns with a dense yellow flame and much smoke, leaving no appreciable ash.

Note.—The oleo-resin is obtained by the operation of "boxing," a diagonal cavity being cut near the base of the trunk; above this incision the bark is removed in successive portions, and on the wounded surfaces the resin-ducts exude the oleo-resin which collects in the "box" and is removed at intervals. The *black* and *white* or *amber* colophony resins differ only in colour and this difference is due partly to the fact that the first runnings from the tree yield the lightest coloured resin, and partly to the variation of the amount of heat used in their preparation from the crude oleo-resin, which, by distillation, yields turpentine and leaves *rosin*. The name Colophony is taken from the Greek town Colophon, where the resin was formerly prepared.

Chemistry.—*Abietic anhydride* $C_{44}H_{62}O_4$ (80 to 90 per cent.), yielding, when warmed with dilute alcohol, *abietic acid*, $C_{44}H_{64}O_5$. It has not yet been definitely proved whether abietic acid exists as such in the resin or as abietic anhydride. *Sylvic acid* and *pinic acid*, formerly regarded as constituents of resin, are now looked upon as decomposition products or impure forms of abietic acid. Resin soaps are prepared by boiling colophony with alkalies.

Uses, etc.—Externally, as an ingredient of ointments and plasters, which it renders stimulating and adhesive.

B.P. Preparations.

Emplastum Calefaciens.
,, Cantharidis.
,, *Resinæ.
,, Menthol.
,, Picis.
,, Plumbi Iodidi.
,, Saponis.
Unguentum Resinæ.

**Used in* Emplastrum Belladonnæ, Emplastrum Calefaciens and Emplastrum Opii.

Note.—*Rosin oil* is a mixture of hydrocarbons, obtained by the dry distillation of rosin. It is collected in two fractions, the heavier of which, on account of its readily resinifiable nature, has been used to adulterate drying oils, the lighter is known as rosin spirit.

DAMMARA.—Dammar Resin.—A resin obtained in the East Indies as a spontaneous exudation from Dammara orientalis, *Lamb.*

N O.—Coniferæ.

Habitat.—East Indies.

Characters.—In transparent, straw-coloured, roundish masses, melting at about 120° C.; nearly odourless and tasteless; partially soluble in alcohol, more so in ether, and almost completely in fixed and volatile oils; entirely soluble in sulphuric acid.

Chemistry.—A mixture of resin acids and resene.

Uses, etc.—As an ingredient of varnishes, rarely used in pharmacy.

Note.—New Zealand Dammar or Kauri (from Agathis australis), also known as Australian Copal, is mainly of fossil origin, and is highly esteemed for varnish making.

SUCCINUM.—Amber.—A fossil resin from various species of submerged coniferous trees, *e.g.*, Pinites succinifer.

N.O.—Coniferæ.

Syn.—Succinite.

Habitat.—Shores of the Baltic, etc.

Characters.—In irregular pieces, yellowish and transparent, resembling bright clear resin. It is hard, but brittle, and breaks with a conchoidal fracture, and is devoid of taste and smell. It is partially soluble in alcohol (one-fourth) and in ether (one-tenth). By destructive distillation succinic acid and "oil of amber" (a terpene) result.

Chemistry.—The alcohol soluble resin is known as *succino-abietic acid*, the remainder consisting of a compound of *succinic acid*, with a resin called *succinoresinol*.

Uses, etc.—For the preparation of succinic acid and "oil of amber." Also largely used in the arts.

Note.—Oil of Amber.—The B.P.C. includes a rectified oil of amber (*Oleum succini*), prepared by destructive distillation and rectification. The product, a pale yellow or colourless, thin liquid of S.G. 0·920, has stimulant and antispasmodic properties, and is used in the preparation of Lin. Succini Co., B.P.C. Much of the commercial Oil of Amber is fictitious.

4. GUM RESINS.—GUMMI-RESINÆ.

This group of products includes the milky exudations of plants dried by spontaneous evaporation, consisting essentially of mixtures of gum and resin, with frequently also a small percentage of volatile oil. When triturated with water, the insoluble resin becomes held in suspension by the gum, and a more or less perfect emulsion results.

CAMBOGIA.—Gamboge.—A gum-resin obtained from Garcinia Hanburii, *Hook, f.* [*Bentl. and Trim. Med. Pl.* vol. i. plate 33].

N.O.—Guttiferæ.

Syns.—Gutta gamba, Gummi gutta.

Habitat.—Siam and Cochin China.

B.P. Characters and Tests.—In cylindrical solid or hollow rolls, longitudinally striated on the surface, either distinct, or more or less agglutinated into masses; breaking with a conchoidal fracture, the fractured surface being dull, smooth, and of a uniform reddish-yellow colour; powder bright yellow; no odour; taste very acrid. When rubbed with *water* it forms a yellow emulsion; it is completely dissolved by the successive action of *alcohol* (90 per cent.) and *water*. When *solution of iodine* is added to a cooled aqueous decoction, the colour should not become distinctly green (absence of more than a trace of starch). When incinerated it should not yield more than 3 per cent. of ash.

Note.—The cylindrical variety (*pipe gamboge*) is obtained by running the juice (latex) obtained from incisions in the bark into the hollow stems of the bamboo-cane, the latter being removed when the gamboge has dried. The drying causes contraction, and as a result of this, holes are often seen through the middle of the cylinders. Some gamboge of inferior quality (*cake* or *lump gamboge*) is sometimes met with in irregular masses of several pounds weight.

Chemistry.—Gambogic acid (the resin) 70 to 75 per cent., and from 20 to 25 per cent. soluble gum. The former is obtained by solution in alcohol and precipitation with water; with alkalies it forms dark red solutions (*gambogiates*). The gum although soluble in water differs from arabin in not being precipitated by solution of subacetate of lead, by ferric chloride or by borax. Gamboge is free from starch and contains little if any fixed inorganic matter. In testing for starch with iodine it should be noted that a green colour would result if this adulterant were present, the mixture of blue and yellow appearing green.

Uses, etc.—As drastic purgative. *Dose.*—1 to 4 grains. Also a valuable colouring agent.

B.P. Preparation.

Pilula Cambogiæ Composita - - 1 part in 6, nearly.

Also occurs in Pil. Cathartic. Co. B.P.C.

MYRRHA.—Myrrh.—A gum-resin obtained from the stem of Balsamodendron Myrrha, *Nees* [*Nees, Pl. Med.* plate 357], and probably other species.

N.O.—Burseraceæ.

Habitat.—Somaliland, Arabia and Abyssinia.

B.P. Characters and Test.—In rounded or irregular tears, or masses of agglutinated tears, varying very much in size; reddish-brown or reddish-yellow externally, dry, and more or less covered by a fine powder; brittle, the fractured surface irregular, somewhat translucent, of a rich brown colour, oily, and frequently exhibiting whitish marks. Odour agreeable, aromatic. Taste aromatic, bitter, and acrid. When moistened with *nitric acid* it assumes a violet colour (distinction from bdellium and false myrrh).

Note.—It has been stated that the true botanical source of myrrh is Commiphora abyssinica and probably also C. Schimperi (Arabia and Abyssinia). The same authorities also assert that Balsamodendron Myrrha not only yields no gum resin, but is even quite free from aromatic properties. Some authorities recognise four varieties of Myrrh, viz., (1) *Somali Myrrh*, (2) *Arabian Myrrh of Hanbury*, (3) *Meetuja or Arabian Myrrh of Dymock* (sold in India), (4) *Timen Myrrh*, which gives, in ethereal solution, no violet colour with bromine. The source officially named is probably the correct one, but for more complete information on the subject the reader is referred to a paper by Holmes [P.J. 1906 [1] p. 254].

Chemistry.—Myrrh contains volatile oil (2·5 to 7 per cent.); resin (*myrrhin*, $C_{32}H_{48}O_{10}$), 20 to 30 per cent.; gum (50 to 60 per cent.); ash (5 to 10 per cent.). The gum, which is dissolved out by water, is partially precipitated by acetate of lead, thus differing from arabin. The resin is soluble in chloroform and alcohol, partially soluble in alkalies and bisulphide of carbon, and has recently been stated to contain *commiphoric acid*, *commiphorinic acid*, and *heerabo-myrrhololic acid*. The insoluble portion remaining from the tincture forms an excellent mucilage with water, which is well suited as a substitute for acacia for common purposes. The volatile oil (*myrrhol*, $C_{10}H_{14}O$) is pale yellow, thick, and has a variable S.G., 0·98 to 1·018. Tincture of myrrh acquires a purple hue on the addition of nitric acid, and an ethereal solution gives, with bromine vapour, a similar reaction.

Uses, etc.—Stimulant and tonic. *Dose.*—5 to 20 grains. A frequent ingredient of gargles and liquid dentifrices.

B.P. Preparations.

Decoctum Aloes Compositum	-	1 part in 200.	
Mistura Ferri Composita	- -	1	,, 75, nearly.
Pilula Aloes et Myrrhæ	- -	1	,, $4\frac{1}{2}$.
,, Galbani Composita	- -	1	,, $3\frac{1}{2}$.
,, Rhei ,,	- -	1	,, 8.
Tinctura Myrrhæ	- - -	1	,, 5 of alcohol (90 per cent.)

B.P.C. Preparations include Tablettæ Aloes et Myrrh., Galbani Co., Rhei Co., Zinci Valer. Co.; Tinctura Aloes et Myrrhæ, Myrrhæ Co. and Myrrh. et Boracis.

Note.—Myrrh is occasionally adulterated by admixture of sand, etc., and other gum resins, and gums are sometimes found in the packages. Bdellium (*q.v.*) has been substituted for it.

Bissa Bôl (*perfumed bdellium*) from Balsamodendron Erythræum var glabrescens, was formerly known in commerce as Indian Myrrh. In appearance it is like an inferior dark-coloured myrrh, having a waxy fracture and possessing an odour which has been likened to that of mushrooms *Balm of Gilead* (*Balsamum Gileadense*—Mecca Balsam) is now but rarely met with in commerce. It is said to be obtained near Mecca, from Balsamodendron Opobalsamum, but not by spontaneous exudation. It is a yellowish or whitish, fragrant, viscid liquid, containing about 30° per cent. of volatile oil and 64 per cent. of hard resin.

BDELLIUM.—Bdellium.—The gum-resinous exudation of (1) Balsamodendron Mukul, *Hook.*, and (2) Balsamodendron (Heudelotia) africanum, *Arn.*

N.O.—Burseraceæ.

Habitat.—(1) India. (2) Africa.

Characters.—*Indian bdellium* occurs in irregular masses or roundish pieces of a dark reddish-brown colour; more moist than myrrh; of a wax-like fracture, translucent in thin layers; somewhat tenacious, softening with the heat of the hand, and adhering to the teeth when chewed. Odour feeble, myrrh-like. *African bdellium* is in irregular, roundish, or oval tears; about an inch in diameter, very hard; varying in colour from pale yellow to brown-red. It is translucent, breaks with a waxy fracture, has but little odour, and a feebly bitter taste.

Chemistry.—Volatile oil (7 per cent., S.G., 0·8836, containing a terpene *bisabolene*, and an oxygenated portion, $C_{56}H_{96}O$), gum-resin, etc.

Uses, etc.—Occasionally in plasters.

OLIBANUM.—Olibanum.—A gum-resin obtained from Boswellia Carterii, *Birdwood*, and other species by making incisions into the inner bark of the tree.

N.O.—Burseraceæ.

Syn.—Thus, Frankincense.

Habitat.—Arabia Felix and the Somali country.

Characters.—In the form of round, oblong, or ovate tears, one-eighth to three-fourths of an inch in diameter, colourless, pale yellow, or of a reddish hue, and generally covered with a whitish powder formed by friction; not very brittle, with a dull and waxy fracture; odour balsamic and resinous; taste acrid, bitterish, somewhat aromatic; softens in the

mouth; the reddish masses soften in the hand, and burn with a fragrant odour It is often mixed with fragments of bark and small crystals of calcium carbonate.

Chemistry.—Volatile oil (8 per cent.), resin (50 per cent.), gum (30 per cent.), other matters (5 per cent.) and ash. The alcohol soluble resin contains *boswellic acid*, *olibano-resene*, and bitter principle. The gum consists chiefly of arabin with some bassorin.

Uses, etc.—The frankincense of the ancients. It is used in the preparation of incense, fumigating powders, pastilles, and as an ingredient in plasters.

ASAFETIDA.—**Asafetida.**—A gum-resin obtained by incision from the root of Ferula fœtida, *Regel* [*Trans. Linn. Soc.*, Ser. 2, Bot. vol. iii. plates 12 to 14] and probably other species.

N.O.—Umbelliferæ.

Habitat.—Afghanistan and Eastern Persia.

B.P. Characters and Tests.—In rounded or flattened tears usually varying in size from half to one inch (twelve to twenty-five millimetres) in diameter, more or less agglutinated. They are dull yellow in colour, and darken on keeping. When fresh the tears are usually tough at ordinary temperatures, but become hard in cold weather. Internally they are yellowish and translucent or milky white and opaque, the freshly exposed surfaces gradually assuming a pink colour which changes to red and finally to reddish-brown. The odour is strong, alliaceous, and persistent; the taste bitter, acrid, and alliaceous. When triturated with *water* Asafetida forms a white emulsion. The freshly fractured surface of a tear touched with *nitric acid* diluted with an equal volume of *water* assumes for a short time a more or less distinct green colour. If a small fragment be strongly heated in a dry-test tube, the contents of the tube, after cooling, yield with boiling *water* a solution which when largely diluted and made alkaline with *solution of ammonia* exhibits a blue fluorescence. Asafetida should contain not less than 65 per cent. of matter soluble in *alcohol* (90 per cent.), and should yield not more than 10 per cent. of ash when incinerated.

Note.—Asafetida comes into British commerce through India, and is largely imported from Bombay. It is occasionally met with in separate tears, but more commonly in masses of agglutinated tears. Large quantities of *stony asafetida*, consisting almost entirely of inorganic substance, are imported, and the standard for ash fixed by the Pharmacopœia is, at the present time, attainable with difficulty.

Chemistry.—*Resin* (40 to 60 per cent.), consisting of *ferulaic acid* ($C_{10}H_{10}O_4$), and a *ferulaic ester* of *asaresinotannol*; *gum* (25 per cent.); volatile oil (3 to 6 per cent.); ash (10 to 30 per cent.). The resin yields *umbelliferone* ($C_9H_6O_3$) under the action of heat or sulphuric acid, and when fused with caustic potash gives resorcin. The oil has S.G. 0·975 to 0·990, and

contains two terpenes and several sulphur compounds having formulæ $C_7H_{14}S_2$, $C_{11}H_{20}S_2$, etc. The question as to whether or not *allyl sulphides* are present is as yet undecided.

Uses, etc.—Stimulant, antispasmodic, laxative, etc. *Dose.*—5 to 15 grains.

B.P. Preparations.

Pilula Aloes et Asafetidæ	1 part in 4.
,, Galbani Composita.	
Spiritus Ammoniæ Fetidus	1 part in 13, nearly.
Tinctura Asafetidæ, 1 part in 5 of alcohol (70 per cent.).	

Asafetida also occurs in the following B.P.C. Preparations :—Mist. Asafetidæ Co., Pil. Asafetidæ, Tab. Galbani Co., Tab. Zinci Valer. Co., and Enema Asafetidæ.

Note.—Sagapenum (*Serapinum*) is an oleo-gum-resin of a Persian tree, a species of Ferula, formerly imported by way of Bombay, but now rarely met with. In appearance it is somewhat similar to asafetida, but does not appear pink at a new fracture, as is the case with the latter, and the odour is also similar to that of asafetida, but is less disagreeable. In medicinal properties it is regarded as being intermediate between galbanum and asafetida. Sagapenum forms an ingredient of Conf. Rutæ B.P.C.

GALBANUM.—Galbanum.—A gum-resin obtained from Ferula galbaniflua, *Boiss and Buhse*, [*Bentl. and Trim. Med. Pl.* vol. ii. plate 128], and probably from other species.

N.O.—Umbelliferæ.

Habitat.—Persia.

B.P. Characters and Tests.—In tears or in masses of agglutinated tears. The tears are rounded or irregular in form, and vary in size from that of a lentil to that of a hazel nut, although rarely exceeding that of a pea; yellowish-brown or orange-brown externally; often rough and dirty on the surface, usually opaque and yellowish-white internally; sometimes more or less translucent, bluish-green in colour, and mixed with transverse slices of the root. They are hard and brittle in cold weather, but soften in the summer, and by the heat of the hand become ductile and sticky. The masses are irregular in form and vary in colour from yellowish-brown to translucent bluish-green. The taste is bitter and unpleasant; both taste and odour are characteristic. If a small fragment is heated to redness in a dry test-tube, the contents of the tube, after cooling, yield with boiling *water* a solution which, when largely diluted and rendered alkaline by *solution of ammonia*, exhibits a blue fluorescence.

Note.—There are two kinds of Galbanum known in commerce, viz., *Levant Galbanum* and *Persian Galbanum*, both, however, coming from or through Persia; the former alone corresponds to the official description. Persian Galbanum, so-called, is commonly softer than the Levant variety, being sometimes of the consistency of Venice turpentine, and differs also from the latter in the possession of a turpentine-like odour, in addition to the characteristic one of Galbanum. It comes into commerce by way of Russia.

Chemistry.—Volatile oil (7 per cent. or more), *resin* (60 to 66 per cent.), *gum* (about 20 per cent.), impurities (7 to 14 per

cent.). The volatile oil, S.G. 0·91 to 0·94, is a colourless liquid, consisting chiefly of terpenes; it boils at 175°C. The resin is a combination of umbelliferone with *galbaresinotannol*. Heated for some time with hydrochloric acid at 100° C. it yields umbelliferone, which can be removed from the acid liquid by ether or chloroform. Fused with caustic potash, galbanum resin yields *resorcin*. By dry distillation a fine blue aromatic and bitter oil is obtained.

Uses, etc.—As stimulant and expectorant. *Dose.*—5 to 15 grains.

B.P. Preparation.

Pilula Galbani Composita - - - - 1 part in $3\frac{1}{2}$.

B.P.C. Preparations.—Emp. Galbani, Tablettæ Galbani Co., Tablettæ Zinci Valer. Co.

AMMONIACUM.—Ammoniacum.—A gum-resin exuded from the flowering and fruiting stem of Dorema Ammoniacum, *D. Don.*; and probably other species [*Trans. Linn. Soc.* Ser. 2, Bot. vol. iii. plates 23 to 25].

N.O.—Umbelliferæ.

Habitat.—Persia and the Punjab.

B.P. Characters and Tests.—In small, dull, pale yellowish or brownish tears, or in nodular masses varying in size from a quarter of an inch to an inch (about six to twenty-six millimetres) in diameter. It is hard and brittle when cold, the freshly fractured surface having a waxy lustre; it softens when warmed. Internally it is opaque and varies in colour from milky white to pale brownish-yellow. It has a faint characteristic but not alliaceous odour and a bitter acrid taste. Triturated with *water* it forms a white emulsion. The freshly fractured surface is coloured yellow by *solution of potassium hydroxide*, and dark red or orange by *solution of chlorinated soda*. If a small fragment be strongly heated in a dry test-tube, the contents of the tube, after cooling, yield with boiling *water* a solution which when largely diluted with *water*, and made alkaline with *solution of ammonia*, does not exhibit a blue fluorescence (distinction from asafetida and galbanum).

Chemistry.—An oleo-gum-resin consisting of *volatile oil* (2 per cent.) containing little or no sulphur; *resin* (70 per cent.), consisting of a mixture of *galbaresinotannol salicylate*, and *ammoresinotannol*; *gum* (28 per cent.), of an arabin-like character. Ammoniacum is destitute of umbelliferone, but when fused with caustic potash yields a little resorcin.

Uses, etc.—Antispasmodic, stimulant, and expectorant. *Dose.*—5 to 15 grains.

B.P. Preparations.

Emplastrum Ammoniaci cum Hydrargyro - 4 parts in 5.
Mistura Ammoniaci - - - - - 1 part in 32.
Pilula Ipecacuanhæ cum Scilla.
,, Scillæ Composita.

B.P.C. Preparations.—Emp. Galbani, Tablettæ Ipecac. c. Scilla, Tablettæ Scillæ Co.

Note.—African Ammoniacum (FERULA TINGITATA) occurs in large, compact, dark heavy masses, formed of agglutinated tears of a hard, waxy consistence. The tears are opaque white or of a pale, greenish-yellow, mixed with others of a blackish-brown, which, with vegetable and earthy impurities, constitute a large portion of the mass. The odour is feeble and different from that of the Persian drug. This variety is now seldom met with, but is said to be the Ammoniac of the ancients.

OPOPANAX.—A gum-resinous exudation from the stem (near the root) of Opoponax Chironium, *Koch.*

N.O.—Umbelliferæ.

Habitat.—Southern Europe.

Characters.—It occurs in irregular-shaped, but usually angular pieces, of a reddish-yellow colour, sometimes speckled white from the recent exposure of the interior. Odour strong and fœtid; taste bitter and acrid. S.G. 1·62.

Chemistry.—Volatile oil (5·9 per cent.), resin (20 to 40 per cent.), and gum (33 per cent.). It forms an emulsion with water. The resin contains *ferulic ester of oporesinotannol* and free *oporesinotannol.*

Uses, etc.—Formerly made use of for purposes similar to those for which the other umbelliferous gum-resins were used; now practically obsolete as a medicine.

Note.—The opoponax oil used in perfumery is said to be the product not of this drug but of Balsamodendron Kataf.

SCAMMONIUM.—Scammony.—A gum-resin obtained by incision from the living root of Convolvulus Scammonia, *Linn.* Known in commerce as virgin scammony.

N.O.—Convolvulaceæ.

Habitat.—Asia Minor.

B.P. Characters and Tests.—Scammony is usually imported in flattened cakes or irregular pieces of varying sizes. It is brown, dark grey, or nearly black externally, and often covered with a greyish-white powder. It is very brittle, and the freshly exposed surface is glossy, resinous, more or less porous, and of a uniform dark-brown or nearly black colour; in thin fragments the drug is brown and more or less translucent. It is easily reduced to an ash-grey powder, and forms an emulsion with *water.* It has a characteristic odour and acrid taste. It should afford only the slightest reactions with the tests for starch, and should yield at least 70 per cent. of resin soluble in *ether*, and not more than 3 per cent. of ash on incineration. An alcoholic solution should not afford a blue

colour with *test-solution of ferric chloride* (absence of guaiacum resin).

Note.—The gum-resin is collected in mussel-shells from the roots, the tops of which are cut off obliquely about two inches from the origin of the stems. Each root yields a few drachms. It is but rarely exported in its pure state, being usually mixed with the compressed juice of the stem and leaves, wheat, flour, chalk, or fine sand, etc. It is often bubble-like on the surface, owing to the presence of air cavities, the result of a species of fermentation. The so-called *virgin* scammony is the best; the *Aleppo* is much adulterated as is the case with nearly all. The usual adulterations, which extend to 50 per cent., are stones, sand, chalk, starch, gum, and gypsum. The amount of ash is a control over the inorganic impurities, for in good products it does not exceed 3 per cent. *Skilip* scammony contains only 30 to 40 per cent. resin, and much wheat starch. The microscopic characters of scammony starch differ from those of wheat starch, hence it is readily detected by the microscope; chalk is detected by the presence of white spots and effervescence with hydrochloric acid. To estimate the amount of resin present, advantage is is taken of its solubility in ether. A spurious scammony, manufactured in the South of France, and known as *Montpellier scammony*, is a mixture of the juice of some unknown plant with various resins and other substances.

Chemistry.—The resin (70 per cent.) is the glucoside *scammonin* (*see* Scammoniæ Radix, p. 48) which has been shown to be identical with *jalapin* (*orizabin*), the purgative principle of male jalap.

Uses, etc.—Similar to those of Scammony Resin. *Dose.*—5 to 10 grains.

B.P.C. Preparations.—Mist. Scammoniæ, Pil. Aloes Co., Pulv. Hydrarg. Subchlor Co., Tinct. Jalapæ Co.

EUPHORBIUM.—Euphorbium.—The resin obtained by incisions from the branches of Euphorbia resinifera, *Berg.*

N.O.—Euphorbiaceæ.

Habitat.—Morocco and other parts of Western Africa.

Characters.—It occurs in irregularly shaped tears, usually pierced with one or two diverging holes made by the double prickles of the plant on which it has dried. Colour dull yellowish-white. The dust causes intense irritation of the passages lined with mucous membrane.

Chemistry.—Amorphous resin (38 per cent.), *euphorbon*, $C_{20}H_{36}O$ (22 per cent., volatile, probably inactive), mucilage (18 per cent.), malates of sodium and calcium (12 per cent.), and 10 per cent. of other inorganic matter. It has recently been stated (Tschirch) that the drug contains no gum.

Uses, etc.—Internally cathartic and emetic; used externally only as vesicant, etc.

5. OLEO-RESINS.—OLEO-RESINÆ.

These are the oleo-resinous juices of plants, containing much resin and varying proportions of volatile oil. In the majority of cases they are obtained by means of incisions made in the trees which yield them, but in some instances they are more or less altered in constitution through the methods used in their production. The oleo-resins are usually liquids more or less thick and viscid according to the relative proportions of volatile oil and resin which they contain. By the prolonged use of a gentle heat the volatile oil may be dissipated—a more or less hard and brittle resin usually remaining.

ELEMI.—Manila Elemi.—A concrete resinous exudation, from Canarium commune, *Linn.*, or Canarium luzonicum, *Gray*.

N.O.—Burseraceæ.

Habitat.—Manila (Philippine Islands).

Characters.—When fresh, soft, granular, resinous and colourless, but by keeping it becomes harder, and of a pale yellow tint. Odour strong and fragrant, somewhat resembling fennel and lemon. Moistened with rectified spirit, it breaks up into small particles, which, when examined by the microscope, are seen partly to consist of acicular crystals.

Chemistry.—Essential oil, $C_{10}H_{16}$ (10 to 12 per cent.), a resin (*amyrin*), amorphous resene, *bryoidin*, *elemic acid*, and bitter extractive.

Uses, etc.—As stimulant for external use; formerly official.

Note.—Other Elemis.—*Mexican Elemi*, *Vera Cruz Elemi*, has now disappeared from commerce; it was a yellow or whitish brittle resin, obtained in Mexico from Amyris elemifera.

Brazilian Elemi, the produce of various species of Icica, has been obtained from Pernambuco; it is a greenish-yellow terebinthinous resin.

Mauritius Elemi, from Colophonia mauritiana, is like Manila elemi in appearance and composition.

Luban Meyeti, an exudation of Boswellia Frereana, obtained near Cape Gardafui, is said by Fluckiger to be the Oriental or African elemi of the olden writers.

Australian Elemi, an exudation obtained in Queensland from Canarium Muelleri, has been described. It is said to be neither identical with, nor allied to, Manila elemi.

TEREBINTHINA CHIA.—Chian Turpentine.—An oleo-resinous exudation from the stems (after incision) of Pistacia terebinthus, *Linn.*

N.O.—Anacardiaceæ.

Habitat.—Islands of Scio, Cyprus and others of the Grecian Archipelago.

Characters.—When fresh it is a transparent liquid, of honey-like consistence, but possessing more tenacity; colour greenish-yellow or yellowish-brown, with little taste, and mild, agreeable, terebinthinate odour. As obtained in commerce, it is a soft solid, becoming brittle. It is entirely soluble in alcohol and ether.

Chemistry.—*Resin* and *volatile oil* (14 to 15 per cent.). The latter is isomeric with oil of turpentine, and has a S.G. of 0·869 and a boiling point of 161° C.

Uses, etc.—Introduced by Dr. Clay as a remedy in the treatment of cancer, and imported by him for that purpose. Said to have been used for the same disease by Paracelsus. *Dose.*—5 to 10 grains in emulsion or pills. Chian turpentine has been used more recently, combined with sesame oil, in the form of a hypodermic injection.

COPAIBA.—Copaiba.—The oleo-resin obtained from the trunk of Copaifera Lansdorfii, *Desf.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 93], and other species of Copaifera, *Linn.*

N.O.—Leguminosæ.

Syn.—Balsam Copaiba; Capivi, etc.

Habitat.—Valley of the Amazon.

B.P. Characters and Tests.—A more or less viscid liquid; generally transparent and not fluorescent; but some varieties are opalescent and occasionally slightly fluorescent; light yellow to pale golden brown, having a peculiar aromatic odour, and a persistent acrid somewhat bitter taste. Its S.G. varies from 0·916 to 0·993. A small quantity, heated until all volatile oil is removed yields a residue which when cold is hard and easily rubbed to powder (absence of fixed oil); and the oil volatilised during the operation does not smell of turpentine. Entirely soluble in *absolute alcohol*, and in four times its bulk of *petroleum spirit*, the latter solution yielding only a filmy deposit on standing. The volatile oil should be present to the extent of at least 40 per cent., should rotate the plane of a ray of polarised light from 28° to 34° to the left (absence of African copaiba), and should not boil under 482° F. (250° C.). When two drops are dissolved in 20 parts of *carbon bisulphide*, and a drop of a cooled mixture of equal parts of *nitric* and *sulphuric acids* added, a transient violet colour is not produced (absence of gurjun balsam). 4 drops of Copaiba, carefully added to a mixture of half an ounce of *glacial acetic acid* with 4 drops of *nitric acid*, should not afford a reddish or purple colour (absence of gurjun balsam).

Allied species, etc.—The drug is exported from Para and Maranham, in Brazil, and also from Maracaibo, Carthagena, Rio Janeiro, Angostura, etc., and the different commercial varieties receive their names from these places. Species other than C. Lansdorffii yielding the drug are C. OFFICINALIS, C. CORIACEA, C. GUIANENSIS, C. MULTIJUGA, etc. The incisions may be made wedge-shaped (the pieces being afterwards replaced) or by means of an augur. Sometimes old trees burst from the internal pressure exerted by the liquid. The flow is often so rapid as to yield ten to twelve pounds in a few hours. The various "balsams" differ considerably in the proportion of oil and resin they contain, Maracaibo and Maranham being thick and rich in resin while Para and Bahia are thin and oily.

Chemistry.—Volatile oil (40 to 70 per cent.), *see* Oleum Copaibæ, the remainder consisting of resins, with a small

amount of bitter principle. The resin is hard, brittle, translucent, greenish-brown, and consists largely of *copaivic acid* ($C_{20}H_{30}O_2$), *oxycopaivic acid*, from Para copaiba, and *metacopaivic acid*, from Maracaibo copaiba. Copaivic acids form crystallizable salts with alkalies, and the balsam is hence frequently prescribed in the form of a soap with potash.

The official limits for the optical rotation of the oil are incorrect, $-7°$ to $-35°$ have been proposed as more accurate.

Uses, etc.—Stimulant, diuretic, laxative, and in large doses, purgative; employed mostly in the treatment of gonorrhœa. *Dose.*—20 to 60 minims.

B.P. Preparation.

Oleum Copaibæ - - - yield, 40 to 70 per cent.

Preparations other than B.P.—Resin of copaiba, prepared by distilling off essential oil with steam. Mist. Copaibæ B.P.C., Liq. Copaibæ and compound liquors B.P.C.

Adulterations of Copaiba.—Gurgun balsam, unlike copaiba, thickens and solidifies when heated, and its admixture with the latter may be detected by the official colour tests. Positive reactions with the colour tests are not very satisfactory evidence of the presence of Gurgun balsam, the determination of acid and ester values affords a better means. If castor oil or any other fixed oil be present, the residue left on driving off the volatile oil is soft and sticky. Turpentine oil may be detected by its odour when the drug is distilled with steam. As a general test of purity the solubility of copaiba in petroleum spirit should be noted, viz., one part in four or less.

Note.—African Copaibas.—Two oleo-resins from Africa, in many respects similar to South American copaiba, have been described; in therapeutic value, however, they are said to be inferior; the oil is dextro-rotary.

DIPTEROCARPI OLEO-RESINA.—Gurgun Balsam.—An oleo-resin obtained from the trunk of Dipterocarpus turbinatus, *Gaertn.*, and other species of Dipterocarpus.

N.O.—Dipterocarpaceæ.

Syn.—Gurjun, Dipterocarpus Oleo-Resin, Wood Oil.

Habitat.—India and East Indies.

Characters.—It is a transparent liquid, S.G. 0·964 (about), of a dark-brown sherry colour, slightly fluorescent, and consequently presenting a greenish opalescence on the surface. It has the consistence of olive oil with an odour and taste resembling copaiba, but less powerful. By heating to 132° C. it becomes turbid and gelatinous, and does not form a clear solution with benzol.

Chemistry.—A *volatile oil* of the terpene series (40 to 80 per cent.), a neutral resin, *gurjuresinol*, and two resin acids allied to those of copaiba.

Uses, etc.—As copaiba, for which it has been substituted, and for adulterating which it is occasionally used; also in China as an ingredient in lacquers. *Dose.*—30 to 60 minims.

THUS AMERICANUM.—Common Frankincense.

—The concrete oleo-resin which is scraped off the trunks of Pinus palustris, *Mill*, and Pinus tæda, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 258, 259].

N.O.—Coniferæ.

Syn.—White Turpentine, Crude Turpentine, Terebinthina communis.

Habitat.—Southern States of North America.

B.P. Characters.—When fresh it is a rather soft, pale yellow, opaque, tough solid, with a terebinthinate odour; but on keeping, it becomes dry, brittle, translucent, darker in colour, and fainter in odour.

Chemistry.—*Volatile oil* (oil of turpentine), 14 to 18 per cent., *resin*, 82 to 86 per cent.

Uses, etc.—Externally as a stimulant.

B.P. Preparation.

Emplastrum Picis.

Note.—Thus Americanum (*Terebinthina, U.S.P.*) in its crude state is the source of American turpentine, which constitutes the bulk of the turpentine of British commerce. It should be noted, however, that the official variety is formed by the last runnings of the oleo-resin which solidifies on the tree.

TEREBINTHINA CANADENSIS.—Canada Turpentine.

The oleo-resin obtained from Abies balsamea, *Mill.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 263].

N.O.—Coniferæ.

Syn.—Canada Balsam.

Habitat.—Canada.

B.P. Characters and Tests.—A pale yellow and faintly greenish transparent oleo-resin, of the consistence of thin honey, with a peculiar and agreeable terebinthinate odour and a slightly bitter feebly acrid taste; drying very slowly, on exposure to the air, into a transparent varnish, and solidifying when mixed with about a sixth of its weight of *magnesia* moistened with a little *water*.

Chemistry.—*Volatile oil* ($C_{10}H_{16}$) 23 to 24 per cent., *resin* about 75 per cent., consisting of *canadinic acid*, *canadolic acid*, *α-* and *β-canadinolic acids*, together with neutral resene. One-fifth of the resin is insoluble in boiling alcohol, but soluble in ether, the remainder being soluble in the first-named liquid.

Uses, etc.—In pharmacy for making the preparation mentioned below. Both the oleo-resin and the resin obtained by dissipating the volatile oil, are used in solution in chloroform or

some other volatile solvent, for making varnish for mounting microscopic objects, etc. *Dose.*—20 to 30 grains.

B.P. Preparation.

Collodium Flexile.

Note.—Canada Balsam is obtained from natural reservoirs in the bark appearing externally as elongated blisters and which are punctured by the sharp spout of the collecting vessel. Turpentine collected from Pinus Picea, *Linn*, is a similar product but possesses a lemon-like odour. Oregon balsam, which has been used to adulterate the true Canada turpentine, is a fictitious product made by dissolving colophony in turpentine.

TEREBINTHINA VENETA.—Venice Turpentine.

The crude turpentine obtained by boring to the heartwood of Pinus Larix, *Linn.* (Larix Europœa). Collected in the Tyrol; formerly imported from Venice.

N.O.—Coniferæ.

Syn.—Larch turpentine.

Characters.—It is a nearly transparent or slightly opaque and somewhat fluorescent, thick liquid, of a terebinthinate odour, a bitter and aromatic taste, and a yellowish or greenish-yellow colour. It is freely soluble in alcohol, amylic alcohol, acetone and glacial acetic acid, and does not become hard when mixed with magnesia.

Chemistry.—It yields, on distillation, 15 to 22 per cent. of essential oil of the formula $C_{10}H_{16}$, consisting chiefly of *pinene*; the remainder being *resin*, consisting of amorphous, α- and β-*larinolic acids*, *laricinolic acid* and a neutral resene.

Uses, etc.—Obsolete as a medicine.

Note.—Adulterations.—A fictitious variety, made by melting together rosin and turpentine, has chiefly, if not entirely, replaced the genuine drug. True Venice turpentine may be distinguished by the length of time required to dissipate the volatile oil when a thin layer is painted upon paper and exposed to the atmosphere.

TEREBINTHINA EUROPŒA.—Bordeaux Turpentine.

—The turpentine obtained in various parts of Europe from various species of Pinus—as P. sylvestris *Linn.*, P. laricio *Poir*, P. maritima *Poir*, etc.

N.O.—Coniferæ.

Syn.—Terebinthina vulgaris, Galipot, etc.

Habitat.—Russia, Finland, Austria, South of France, etc.

Characters.—Viscid, honey-like, yellowish, somewhat opaque, becoming transparent by exposure to the air; odour agreeable, taste warm and bitterish. When long kept in bottle, separating into two layers, the upper clear and somewhat fluorescent, the lower granular, through the presence of numerous crystals of abietic acid.

Chemistry.—Similar to that of Thus, *q.v.*

Uses, etc.—As a stimulant, etc., in plasters.

Note.—The oil of turpentine, distilled from European turpentines, is little met with in England, our supply being almost entirely from America. French oil of turpentine (from P. maritima) differs from the American (English) and Russian oils in being strongly lævo-rotatory.

6. EMPYREUMATIC OILS.—OLEA EMPYREUMATICA.

These are complex liquids of an oleo-resinous nature, obtained by the destructive distillation of various organic substances, such as wood, bones, etc.

PIX LIQUIDA.—Tar.—A bituminous liquid, obtained from the wood of Pinus sylvestris, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 257], and other species of Pinus, by destructive distillation. Known in commerce as Stockholm tar.

N.O.—Coniferæ.

Syn.—Wood tar.

Habitat.—Arctic Europe and Asia.

B.P. Characters and Tests.—A dark-brown or blackish semi-liquid substance, of a peculiar aromatic odour. The S.G. varies from 1·02 to 1·15. *Water* agitated with it acquires a pale-brown colour, sharp empyreumatic taste, and acid reaction, and with dilute *test-solution of ferric chloride* assumes a red colour. Tar is completely soluble in ten times its volume of *alcohol* (90 per cent.).

Note.—The wood yields between 7 and 8 per cent. of tar. There are three kinds of wood tar in commerce:—*Stockholm* or *Archangel tar*, *American tar*, and a tar obtained as a bye-product in the manufacture of crude acetic acid and gunpowder charcoal. The first alone is official, and is the best for medicinal use. The decomposition of wood by heat commences at 160° C.; amongst the products are:—(*a*) Gaseous.—Carbonic anhydride, carbonic oxide, hydrogen and steam. (*b*) Liquid.—Acetic acid, wood spirit (naphtha), methyl acetate and acetone in conjunction with water, in which they are all soluble. The remainder is empyreumatic oil, insoluble in water. (*c*) Solid.—A black resin (pitch), which, when wood tar is distilled, remains behind in the retort. This was formerly used in medicine under the name of *Pix nigra* or *Pix navalis*. Many of these products contain much oxygen, their composition thus differing greatly from that of the substances obtained by the distillation of coal.

Chemistry.—(*See* note *above*). The empyreumatic oil is of a highly complex character, and contains hydrocarbons such as *toluene*, *xylene*, *mesitylene*, etc., phenols such as *phenol*, *cresol guaiacol*, *creosol*, *phlorol*, *methyl-creosol*, etc. In addition to these there are present paraffin, naphthalene, pyrene and pyrocatechin.

Uses, etc.—Stimulant, antiseptic; used externally in skin diseases. *Dose.*—20 to 60 minims. It yields up a small proportion of its constituents to water, producing *tar water*. Creosote (*see below*) is obtained from wood tar.

B.P. Preparation.

Unguentum Picis Liquidæ.

Note.—The B.P.C. and U.S.P. include a syrup of tar, the former also has a styptic gauze containing Stockholm Tar, and non-official alcoholic solutions and paints, etc., for external use are prepared.

Creosotum, P.B., is a liquid obtained by the fractional distillation of wood tar. It consists chiefly of guaiacol and creosol—some varieties containing more of the former, others more of the latter. Its S.G. should

not be less than 1·079, it does not coagulate albumen, and gives a green to red and brown colour with ferric chloride (distinction from phenol). The official requirements are met by a creosote distilled from beechwood tar.

OLEUM CADINUM.—Oil of Cade.—An empyreumatic oily liquid obtained by the destructive distillation of the woody portions of Juniperus Oxycedrus, *Linn.*, and some other species.

N.O.—Coniferæ.

Syn.—Huile de Cade : Juniper Tar Oil.

Habitat.—Europe (Mediterranean regions).

Characters.—A dark reddish-brown or nearly black, more or less viscid, oily liquid, with a not unpleasant empyreumatic odour, and an aromatic, bitter and acrid taste; S.G. about 0·990. It is soluble in ether and chloroform; partially soluble in cold, almost wholly in hot rectified spirit. In water it is very slightly soluble. The filtered aqueous solution is almost colourless, and possesses an acid reaction.

Chemistry.—The oil contains the sesquiterpene *cadinene* $C_{15}H_{24}$, in other respects it resembles wood tar.

Uses, etc.—As external stimulant in skin diseases.

Note.—Oil of Cade is frequently substituted by other tars; the B.P. Codex gives tests for their detection. *Oleum Rusci* (*Oleum Betulæ Albæ, Birch tar*) is a bituminous liquid obtained by the destructive distillation of the wood of BETULA ALBA. It has a peculiar odour which it imparts to Russian leather. Its activity as a medicine is due to the presence of guaiacol and cresol, and it contains also much pyrocatechin. It is used in skin diseases.

OLEUM ANIMALE EMPYREUMATICUM.—Empyreumatic Animal Oil.—An empyreumatic oil obtained by the destructive distillation of bones and other animal substances, purified by redistillation.

Syn.—Animal oil, bone oil, Dippel's oil.

Characters.—The purified oil is a yellowish, thin oily liquid, of S.G about 0·800. It has a characteristic penetrating odour, and a pungent, acrid and bitter taste. It has a faintly alkaline reaction, and is readily soluble in alcohol, ether and oils. On exposure to the air it becomes darker in colour and thicker in consistence.

Chemistry.—Highly complex. Contains *pyrrol, pyridine, picoline, lutidine, collidine,* etc., in addition to *methyl-, ethyl-* and *propyl-amines.*

Uses, etc.—Formerly given in typhus, epilepsy and other diseases, also as an external stimulant. Pyridine has been recommended in asthma and allied complaints.

7. BALSAMS.—BALSAMA.

The term balsam was formerly applied indiscriminately to oleo-resinous substances generally, but it is now customary to include under this head those aromatic resins and oleo-resins only, which contain cinnamic or benzoic acid or both.

BALSAMUM TOLUTANUM.—Balsam of Tolu.

—A balsam obtained by making incisions in the trunk of Myroxylon Toluifera, *H. B. and K.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 84].

N.O.—Leguminosæ.

Habitat.—Venezuela and New Granada.

B.P. Characters and Tests.—When first imported it is a soft and tenacious solid, which on keeping becomes harder, and then, in cold weather, brittle. In thin films it is transparent and of a yellowish-brown colour. Pressed between pieces of glass with the aid of heat, it exhibits, when examined with a lens, an abundance of crystals. Odour highly fragrant, especially when warmed; taste somewhat aromatic and slightly acid. It is soluble in *alcohol* (90 per cent.) and the solution has an acid reaction. If 5 grammes are gently warmed with two successive portions of 25 and 10 cubic centimetres of *carbon bisulphide*, the solution should yield, when evaporated to dryness, a distinctly crystalline residue which should require not less than one-third of its weight of *potassium hydroxide* for its saponification (presence of a sufficient proportion of benzoates and cinnamates).

Note.—Mode of Collection.—Two sloping notches are cut through the bark, meeting at their lower ends in an acute angle, below which the bark and wood are hollowed out a little to receive the calabash cup into which the balsam flows. Many of these V-shaped cuts are made on the same tree. The contents of the cups are put into flask-shaped bags made of raw hide, a pair of these being slung over the back of a donkey. These bags are transferred to depots on the Magdalena river, when the contents are received into cylindrical tins.

Chemistry.—Amorphous resin, about 80 per cent. (a compound of *toluresinotannol*, with cinnamic and a little benzoic acid), *cinnamic acid* (12 per cent.), *tolene* (volatile oil, 1 to 2 per cent.), *vanillin* (a trace), *benzyl benzoate* and *benzyl cinnamate*. Tolu balsam is freely soluble in chloroform, glacial acetic acid, acetone, ether, alcohol and liquor potassæ; scarcely soluble in petroleum-benzine and benzol.

Uses, etc.—Stimulant, expectorant, etc. *Dose.*—5 to 15 grains.

B.P. Preparations.

*Syrupus Tolutanus - - - 1 part in 29, nearly.

Tinctura Benzoini Composita.

† ,, Tolutana, 1 part in 10 of alcohol (90 per cent.).

**Used in the preparation of* Mistura Ammoniaci.

†*Contained in* Tolu lozenge basis.

The *B.P.C.* contains a Liquor Tolutanus.

Adulterations.—Turpentines may be detected by the odour on distillation with steam and by their ready solubility in carbon bisulphide. Styrax and other adulterants may be detected by treating the carbon bisulphide extracts with sulphuric acid; in the absence of impurities the balsam gives a cherry-red, in their presence a dark-brown colour. Exhausted Tolu, colophony and many other adulterants can be detected by determining the percentages of free and combined aromatic acids.

BALSAMUM PERUVIANUM.—Balsam of Peru.

—A balsam exuded from the trunk of Myroxylon Pereiræ, *Klotzsch* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 83], after the bark has been beaten and scorched.

N.O.—Leguminosæ.

Syn.—Toluifera Pereira; Myrospermum Pereira.

Habitat.—Central America.

B.P. Characters and Tests.—A viscid liquid, in bulk nearly black, but in thin layers deep orange-brown or reddish-brown, and transparent. It has an agreeable balsamic odour and an acrid taste; when swallowed it leaves a burning sensation in the throat. It is insoluble in *water*, but soluble in *chloroform*. 1 volume is soluble in 1 volume of *alcohol* (90 per cent.), but on the further addition of 2 or more volumes of the *alcohol*, the mixture becomes turbid. S.G. between 1·137 and 1·150. 10 drops triturated with 0·4 gramme of *lime* produce a permanently soft mixture (absence of copaiba and resins); and this, on being warmed until all volatile matter is given up and until charring commences, gives no fatty odour (absence of castor oil and other fatty oils). It should not diminish in volume when shaken with an equal bulk of *water* (absence of ethylic alcohol). About 40 per cent. of resin should separate when one part of the Balsam is treated with three parts of *carbon bisulphide*; and the clear supernatant liquid should be of a pale brown colour with only a slight fluorescence (absence of gurjun balsam). If 5 grammes of the Balsam be shaken with 5 cubic centimetres of a solution of *sodium hydroxide* of specific gravity 1·16, and then washed with three successive quantities, each of 15 cubic centimetres, of purified ether, and the ether removed, the residue (after cautious drying until the loss, in two weighings at 5 minutes' interval, does

not exceed one centigramme) should weigh between 2·85 and 3 grammes. To this weighed residue 20 cubic centimetres of *normal volumetric alcoholic solution of potassium hydroxide* and 40 cubic centimetres of *alcohol* (90 per cent.) are to be added and the whole saponified under a reflux condenser for one hour. Thus treated, the residue above specified should combine with from 11·9 to 12·8 cubic centimetres of the *normal volumetric alcoholic solution of potassium hydroxide* (presence of a sufficient proportion of cinnamein). The amount of uncombined alkali may be determined in the usual way by means of titration with the *volumetric solution of sulphuric acid*.

Note.—Mode of Production.—The bark is first beaten with mallets and then scorched, which causes it to separate; rags are placed between wood and bark to absorb the exuded balsam and these are afterwards boiled in water, the balsam sinking to the bottom of the vessel. After removal of water it is placed in gourds or metallic drums. This constitutes *balsamo-negro*. The semi-solid substance, known as *balsamo-blanco*, or white balsam, is obtained by expression from the seeds and inner portion of the fruit of the same tree. It has been confounded with Tolu, but the odour is marked and quite distinct.

Chemistry.—The mode of preparation adopted causes chemical changes in this balsam, and at the same time gives it a darker colour; naturally it should be much like Tolu balsam. It contains amorphous resin (*peruresinotannol* combined with cinnamic and a little benzoic acid), 32 to 38 per cent., *benzyl cinnamate* (*cinnamëin*), *benzyl benzoate*, *peruviol*, together with *free cinnamic acid* and traces of *styrol*, *stilbene*, *vanillin*, etc.

Uses, etc.—As stimulant, expectorant, etc. *Dose.*—10 to 15 minims. Used also externally in the form of an ointment.

Adulterations.—Alcohol, fixed oils, copaiba and gurjun oleo-resins, colophony, etc., most of these are detected by the application of the B.P. tests. An artificial Balsam of Peru is sometimes substituted for the genuine, it gives similar qualitative results when examined by the official test but according to the B.P. Codex may be distinguished by the application of nitric acid (S.G. 1·38) to a petroleum spirit extract. Genuine balsam will give a golden yellow colour.

Note.—The term Peruvian is a misnomer, acquired through the balsam having been at one time shipped at Peruvian ports.

The *B.P.C.* includes Unguentum Peruvianum.

STYRAX PRÆPARATUS.—Prepared Storax.—A balsam obtained from the trunk of Liquidambar orientalis, *Miller* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 107], and purified by solution in ethylic alcohol, filtration, and evaporation of the solvent.

N.O.—Hamamelaceæ.

Syn.—Styrax Liquidus.

Habitat.—Asia Minor.

B.P. Characters.—A semi-transparent brownish-yellow semi-fluid balsam, about the consistence of thick honey, with a strong agreeable odour and balsamic taste. Heated in a test-tube on

the vapour bath, it becomes more liquid, but gives off no moisture; boiled with solution of bichromate of potassium and sulphuric acid it evolves an odour resembling that of essential oil of bitter almonds.

Note.—To obtain the balsam the outer bark is bruised and as a result of the injury the balsam exudes into the inner bark. The outer bark is rejected and the inner is boiled in water, by which means the balsam is separated. The bark is then packed in horse-hair bags and strongly pressed in a wooden press; hot water being thrown on the bags, and pressure renewed as long as any balsam can be obtained. Thus prepared, it is taken to Smyrna and shipped chiefly to Trieste.

Chemistry.—Storax yields a small percentage of volatile oil containing *styrene* and various cinnamic esters. Otherwise the balsam consists of a mixture of a resin, *storesinol* partly free and partly in combination with cinnamic acid, with an oily liquid containing free *cinnamic acid*, *vanillin*, *styrol*, *styracin* (cinnamyl cinnamate), *ethyl cinnamate*, and *phenyl-propyl cinnamate*. Crude storax contains from 1 to 9 per cent. of matter insoluble in alcohol and up to 30 per cent. of water.

Uses, etc.—As stimulant and expectorant.

B.P. Preparation.

Tinctura Benzoini Composita.

Allied Balsams.—*Solid storax* (*store storax*), now unobtainable, was derived from the gum of S. officinalis (*N.O.*—Styraceæ). An artificial solid storax (*Styrax Calamita*) is prepared artifically in the Levant by mixing sawdust with liquid styrax, and other mixtures, prepared in various ways, are found in commerce under the same name. *Sweet Gum* is obtained in N. and S. America by spontaneous exudation from Liquidambar styraciflua (*N.O.*—Hamamelaceæ). It is described as a thick, brownish-yellow, clear, aromatic liquid, solidifying in the cold. It contains an odorous hydrocarbon, and in other respects much resembles liquid storax. Aromatic resins are also obtained in China from Liquidambar formosana and in Java and Burmah from Altingia excelsa (Liquidambar altingiana).

Note.—*Cortex Thymiamatis* is the bark from which storax has been obtained, it retains the odour of the balsam.

8. VOLATILE OILS.—OLEA VOLATILIA.

Volatile or essential oils are odorous liquids derived from vegetable sources, vaporisable without decomposition, possessing characteristic odours and capable of imparting a temporary translucent stain to paper. Most essential oils are lighter than water—the specific gravity usually being between 0·850 and 0·950. They are usually soluble in 95 per cent. alcohol, in ether, in fixed oils, but only very slightly so in water. By a reduction in temperature many volatile oils may be divided into two portions—a liquid so-called *elæoptene* and a solid crystalline *stearoptene* or *camphor*—the latter constituent usually differing from the former in containing oxygen, the separation being however a purely physical one. Another notable property of many essential oils is their power of rotating the plane of polarized light. This in most cases is very marked, and often affords a highly useful means of distinguishing oils and of detecting adulterations.

Methods of Extraction, etc.—Volatile oils occur in various parts of the plants which yield them; thus they are found in epidermal glands of capitate and peltate form, *e.g.*, Thymus, Humulus; in short lysigenous cavities, *e.g.*, Rutaceæ (orange, etc.); in tube-like structures, *e.g.*, vittæ of Umbelliferæ; in schizogenous passages or ducts, *e.g.*, Coniferæ, Umbelliferæ, Anacardiaceæ, etc., where they are generally associated with resins. For the extraction of essential oils the methods adopted are various, it being necessary to take into consideration not only the nature of the drug to be operated upon, but also the constitution of the oil to be obtained. Thus, in the case of many delicate flavouring essences and others used in perfumery, care must be taken to preserve the delicate aromas which belong to these essences. In some few cases (mustard, almond, etc.), the oils do not pre-exist in the plant, but are the result of chemical action brought about during the process of manufacture. The following are some of the processes adopted in obtaining essential oils:—

(a.) *Distillation.*—This is best conducted in a steam-jacketed still, having a false wooden bottom. The drug is placed in the still and covered with water, the oil passing over with the water being separated from it by means of a Florentine receiver or some other kind of separator. In some cases salt is added to the water in the still in order to raise the boiling point.

(b.) *Passage of Steam through the drug.*—This process is very similar to the first, the steam being supplied by a pipe entering the still at such a point as to permit the complete saturation of the drug with water vapour. Here again the Florentine receiver may be used, and the last portions of water are removed from the oil by means of calcium chloride or some similar water-absorbing salt.

(c.) *Cold Expression.*—In using this method, which is adopted chiefly in the case of fruits, such as oranges, lemons, etc., the oil vesicles are ruptured either by squeezing, pricking or grating, and the exuding oil is collected and purified by filtering, etc. In Sicily, for obtaining oil of lemon, etc., two processes are made use of—(1) the *scorzetta*, (2) the *spugna* process. The first is used when the peel, after partial expression, is destined for conversion into candied peel. The fruit is cut into two halves and the pulp removed by a special pulping spoon. The peel, after steeping in water, is pressed against a sponge, the intention being to retain sufficient oil in the peel to enable it to be used for candying. In the *spugna*, or sponge process, the lemon peel is cut off the pulp in three slices, soaked in water, and then the oil is expressed by the fingers into a sponge. Machines are in use for obtaining the oil but not to any great extent. In the South of France the *écuelle à piquer* is chiefly made use of for obtaining these oils. This consists of a funnel-like vessel having at its centre a number of stout pins, by means of which the peel is pierced and the oil which runs through into the tube of the funnel may be collected below. The method of *grating* is very similar, and is sometimes adopted in obtaining oil of bergamot. The residuary rind from any or all of these processes contains a certain amount of oil which the means used do not liberate, and this is sometimes removed either by hydraulic pressure of the mass in horse-hair bags or by distillation with water, the product in the latter case being, however, much inferior in aroma to the oil obtained by cold expression.

(d.) *Enfleurage.*—This is the process employed at Grasse and other places for obtaining the perfume of flowers (*e.g.*, jasmin, etc.). It consists in placing the flowers on sheets of glass smeared with lard or some other fat. The latter, which acts as a solvent, after a time becomes impregnated with the odour of the flowers. A similar result may be obtained by macerating the flowers in melted fat. For perfumery purposes the essential oil is recovered from the fat by long-continued shaking with cold alcohol, the separated alcoholic solutions occuring in commerce as "triple" extracts.

(e.) *Solution.*—In some cases essential oils may be removed by treating the drug with solvents—such as light petroleum, ether, etc. The solvents are subsequently removed by gentle evaporation, and the oil may, if necessary and desirable, be distilled with water to purify it.

General Chemical Characters of Volatile Oils.—Though frequently highly complex bodies, volatile oils usually owe their distinctive characters to one, two, or more chief constituents. The chemical nature of these varies considerably—the following being the groups of compounds most frequently met with:—

(a.) *Terpenes* ($C_{10}H_{16}$).—These constitute the bulk of a large number of volatile oils. They are so-called from oil of turpentine,

which is the type of the true terpenes. There are several varieties of terpene, including the *lævo-pinene* of French oil of turpentine, etc.; the *dextro-pinene* of English (American) oil of turpentine, oils of wormwood, green-mint, nutmeg, etc. Other terpenes are the solid *camphene*, obtained from pinene hydrochloride; *phellandrene*, contained in some varieties of eucalyptus oil, and forming a characteristic nitroso compound when treated with sodium nitrite; *dextro-limonene (citrene, carvene, hesperidene)*, contained in oils of lemon, dill, orange, cumin, etc., *sylvestrene* (found in Swedish and Russian turpentine oils); *terpinene* of oil of cardamoms; and *dipentene* (*cinene*, *inactive limonene*), contained in camphor oil, oils of cascarilla and fennel. Other terpenes not found in nature but obtainable from allied bodies are—*fenchene*, obtained by reducing fenchone (*vide infra*); *thujene* from thujone; *clovene* from caryophyllene, etc.

Sesquiterpenes ($C_{15}H_{24}$) are also frequent constituents of volatile oils, *cadinine* in oils of cade, galbanum, etc., *caryophyllene* in clove oil, *humulene* in hop oil, etc. *Diterpenes* ($C_{20}H_{32}$) are the chief constituents of resin oil, and *polyterpenes* ($nC_{10}H_{16}$) occur in caoutchouc.

In addition to the terpenes other hydrocarbons nearly allied to them are found in ethereal oils, *e.g. cymene* ($C_{10}H_{14}$), occurring in oils of cumin, thyme and ajowan, and having the constitution of a methyl-propyl-benzene.

(b). *Aldehydes.*—The oils of bitter almonds (*benzoic aldehyde*); of cinnamon, cassia, etc. (*cinnamic aldehyde*); of rue (*several aldehydes*); vanillin (*methyl-protocatechuic aldehyde*), belong to this class of bodies, as also does the *salicylic aldehyde* of oil of spiræa; the *anisic aldehyde* of oils of aniseed; the *cuminic aldehyde* of cumin oil, and *citral* ($C_{10}H_{16}O$) or geranaldehyde, the aldehyde of geraniol, which as the odoriferous principle of oil of lemon and of other fruits of the genus Citrus, of lemon-grass oil and of the oil of Eucalyptus citriodora, is of great importance. Like other aldehydes, it forms a crystalline compound with bisulphites, and this character is made use of in the assay of lemon oils. Its constitutional formula, according to Tiemann, is

$$(CH_3)_2C : CH.CH_2.CH_2.C(CH_3) : CH.COH.$$

Citronellal, $C_{10}H_{18}O$, the aldehyde of citronellol, occurs in citronella and other oils. It has constitutional formula

$$C(CH_3)_2 : CH.CH_2CH_2.CH(CH_3)CH_2.COH,$$

and may be separated from citral by making use of the fact that its barium bisulphite compound is insoluble, whilst that of citral remains in solution.

(c). *Ketones.*—Of this class *camphor; fenchone*, of oil of fennel; *thujone*, of oils of thuja, wormwood and sage; *pulegone*, of oils of pennyroyal and horsemint; *menthone* (not menthol), of oil of peppermint; and *carvol* or *carvone*, of oils of caraway and dill, are the most important members. Carvone forms a crystalline compound with hydrogen sulphide.

(d). *Alcohols.—Geraniol* ($C_{10}H_{18}O$), formerly called *rhodinol*, is a type of this class. It is found in rose-geranium and other oils, and forms a crystalline compound, *geraniol diphenyl-urethane*, when heated with diphenyl carbamine, calcium chloride and pyridine. It is of an alcoholic character, and is said to have constitution as follows,

$$(CH_3)_2C : CH.CH_2.CH_2.C(CH_3) : CH.CH_2OH.$$

Linalool ($C_{10}H_{18}O$) is isomeric with geraniol, from which it may be obtained, as also from oil of linaloe. It is found chiefly in the form of acetate (*linalyl acetate*) in oils of linaloe, lavender and bergamot. Its constitution is shown by the formula

$$CH_3.C(CH_3) : CH.CH_2.CH_2.C(CH_3)\ (OH).CH : CH_2.$$

Citronellol, $C_{10}H_{20}O$, is an alcohol nearly allied to geraniol, and associated therewith in oil of roses (otto of rose), it is obtainable from *citronellal* (*q.v.*) by reduction. Tiemann assigns to it the formula

$$C(CH_3)_2 : CH.CH_2.CH_2.CH(CH_3).CH_2.CH_2.OH.$$

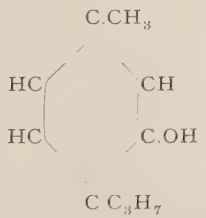
To this class also belong *borneol* (Borneo camphor) and the artifically-prepared bodies, *fenchyl alcohol*, *thujyl alcohol*, *terpineol* and *pulegol*. Borneol is the alcohol corresponding to the ketone camphor and pulegol has a similar relation to pulegone.

(e). *Phenol derivatives.*—Of these there are many and chief among them may be mentioned *eugenol*, the methyl ether of *allyl-dioxybenzene*, having formula which may be written thus :—

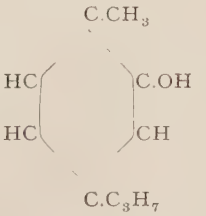
$$C_6H_3 \begin{cases} C_3H_5. \\ OCH_3. \\ OH. \end{cases}$$

It occurs in oils of clove, allspice, bay, cinnamon leaf, etc.

Safrol (from oils of sassafras, anise, camphor, etc.) is the methylene-ether of *allyldioxybenzene*, and has formula $C_6H_3.C_3H_5.O_2CH_2$. *Apiol*, $C_{12}H_{14}O_4$ (from parsley oil), is the dimethyl methylene ether of *allyl tetroxybenzene*. *Diosphenol*, $C_{10}H_{16}O_2$, from oil of Buchu, is regarded as a phenolic aldehyde. *Thymol* (from oil of thyme, etc.) and *carvacrol* (from oils of thyme, origanum, cumin, etc.) are isomeric *methyl-propyl phenols* or *propyl creosols* having the hydroxyl radicle differently arranged in the benzene ring, thus :—



THYMOL.



CARVACROL.

Chavicol, which occurs in the oil of chavica betle, has been shown to be *para-allyl phenol* $C_6H_4(OH)$ (C_3H_5), and of this body *anethol* is the methyl ether $C_6H_4(O.CH_3)$ (C_3H_5).

(f). *Esters.*—Among the most important esters or ethereal salts found in essential oils are *methyl salicylate* (wintergreen oil), *allyl isothiocyanate* (mustard oil), *bornyl acetate* (pine oil), *linalyl acetate* (lavender oil). In addition to these there are others less important, *e.g.*, *ethyl benzoate* (found in oil of ylang-ylang), *allyl sulphide* $(C_2H_5)_2S$ (in oil of garlic), *angelic* and *tiglic* (methyl crotonic) *acids* $CH_3.CH : C.CH_3.COOH$, found in the form of esters in oil of angelica root, Roman oil of cumin, etc.

"Terpeneless" Oils.—The considerable researches into the constitution of essential oils which have taken place during the last few years have led in many cases to a correct apportionment of the relative value of their constituents, and to attempts to supply the market with oils consisting of the odoriferous principles more or less entirely freed from the flavourless substances with which they are naturally associated. These latter are in the vast majority of cases terpenes, and by their removal the so-called terpeneless oils are produced. A terpeneless oil possesses the triple advantage of being (1) concentrated in form; (2) much more soluble in alcohol; (3) less liable to decomposition by age. The removal of the terpene is usually effected by fractional distillation *under reduced pressure*, by which means the hydrocarbons of lower boiling point are made to pass over first, leaving the oxygenated portion behind. The resulting terpene distillate not infrequently finds its way on to the market as a so-called "light oil" of the drug from which it is obtained or as a diluent of other oils, while the oxygenated portion with or without further treatment is the terpeneless oil of commerce. It is an important fact, however, that the proportion of oxygenated constituent present in an oil is by no means always a measure of its value as a perfuming or flavouring agent, and it is also to be noted that many oils of delicate aroma suffer deterioration by distillation even under reduced pressure. *Terpeneless oil of lemon*, may be taken as a type of its class. It consists when properly prepared of the aldehydes citral and citronellal, together with small quantities of esters and other bodies. It has S.G. about 0·895, and is soluble in all proportions of alcohol (90 per cent.) and to a considerable extent in alcohol (70 per cent.) The terpene removed from oil of lemon is sold under the title of "*Citrene*."

Isolation of Constituents of Essential Oils.—In addition to the generally useful method of fractional distillation other means of isolating the constituent parts of essential oils may be adopted. It may be brought about by producing the reaction peculiar to the class of bodies to which the constituents belong; *e.g.* hydrocarbons (terpenes, etc.) may be separated by forming crystalline halogen derivatives; aldehydes and ketones by

means of the crystalline compounds formed when these bodies are acted upon by alkaline bisulphites; alcohols (menthol, etc.) by fractional crystallization and by the formation of esters having distinctive characters; phenols and ethereal salts by saponification.

Adulteration.—The adulterants most commonly made use of for sophisticating essential oils are alcohol, terpenes and fixed oils. Alcohol may be detected by adding fuchsine or tannin to the oil, when, if spirit be present, these substances are dissolved. Oil of turpentine may often be detected by its odour, or in an oil free from terpene by adding iodine, when, if adulterated, heating or even explosion will take place. Fatty oils may be detected by leaving a greasy permanent stain on paper, by their non-solubility in alcohol, or by their odour, and when other saponifiable bodies are absent, by treatment with caustic alkali. The presence of water in an essential oil may be detected by adding to it a few chips of dried calcium chloride—these rapidly lose their angularity if water be present. Generally, adulteration is best detected by observing certain physical characters such as specific gravity, degree of optical rotation, index of refraction, solubility in alcohol, etc., and where possible, making a determination of the proportion of any typical constituent or constituents present. The characters of genuine oils usually fall within definite limits, and any departure from these will afford *prima-facie* evidence of adulteration or abnormality. Specific tests for adulteration can be employed according to the indications afforded by the general examination.

(For more detailed information respecting the chemistry of essential oils the student is advised to consult *The Chemistry of Essential Oils, etc.*, by Ernest J. Parry.)

OLEUM SINAPIS VOLATILE.—Volatile Oil of Mustard.—Distilled from Black Mustard Seeds after maceration with water.

B.P. Characters and Tests.—Colourless or pale yellow. Has an intensely penetrating odour and a very acrid taste. Applied to the skin it produces almost immediate vesication. S.G. 1·018 to 1·030. It distils between 147·3° C. and 153·2° C., and the first and last portions of the distillate should have the same specific gravity as the original oil (absence of ethylic alcohol and petroleum).

Chemistry, etc.—Essential Oil of Mustard consists almost entirely of allyl isothiocyanate C_3H_5CSN, and the enzyme reaction by which the oil is produced is described under *Sinapis Nigræ Semina.*

It can be prepared synthetically by the interaction of allyl iodide and potassium thiocyanate. The formation of the oil from the seeds is prevented by a temperature higher than

60° C., or by the addition of alcohol, for these agents coagulate the nitrogenous fermentative principle myrosin and thus render it inert; hence in the preparation of mustard for the table, or for poultices, cold or tepid water should always be used. The yield from the seeds is about 1 per cent.

OLEUM LIMONIS.—Oil of Lemon.—The oil obtained from fresh Lemon Peel.

Syn.—Essence of Lemon.

B.P. Characters and Tests.—Pale yellow, with the fragrant odour of the lemon and a warm, bitterish, aromatic taste. S.G. 0·857 to 0·860. It should rotate the plane of a ray of polarised light not less than 59° to the right in a tube 100 millimetres long; and if 100 volumes be fractionally distilled, the 10 volumes first collected should not produce a rotation differing by more than 2° from that produced by the original oil.

Chemistry, etc.—Lemon oil contains upwards of 90 per cent. of terpenes, being *dextro-* and *lævo-limonene*. The important constituent is the aldehyde, *citral* ($C_{10}H_{16}O$), which occurs to the extent of from 3 to 4 per cent. in pure oils. Traces of *phellandrene*, of *citronellal*, of (in Messina oil) *geranyl acetate*, and (in Palermo oil) *linalyl acetate*, together with other unimportant bodies, have been described as present.

Note.—Citral, the essential constituent of the oil, is *geraniol aldehyde* (*geranaldehyde*) and may be obtained by the oxidation of its alcohol, geraniol. It has the constitution $(CH_3)_2C.CH.CH_2.C(CH_3).CH.CHO$. With sodium bisulphite solution it forms a compound insoluble in ether, and by this means may be separated from the non-aldehydic compounds with which it is associated in lemon and other oils.

Oil of Lemon is soluble in 12 parts of 90 per cent. alcohol, in all proportions of absolute alcohol, and an admixture of 10 per cent. of the latter is stated to have the effect of preserving its flavour and aroma. The oil is much adulterated, chiefly with oil of turpentine, which is difficult to detect if present in small proportions, but may sometimes be recognised by the odour left after evaporation of some of the oil from a piece of filter paper; or the oil may be fractionally distilled, and an examination of the fractions made. Pinene has been proved absent from genuine lemon oil and its presence is sure evidence of adulteration with turpentine oil. The most dangerous adulteration, since it is extremely difficult of detection, is that with the terpenes obtained as a bye-product in the manufacture of terpeneless oil of lemon. A determination of Citral is of little value, since such an oil may have been doctored with citral derived from cheaper sources, such as lemon-grass oil. The mode of preparation of Lemon oil has already been described (*see page* 261).

OLEUM RUTÆ.—Oil of Rue.—The oil distilled from the fresh herb of Ruta graveolens, *Linn.*, a native of Southern Europe, but common also in gardens in this country.

N.O.—Rutaceæ.

Habitat.—Southern Europe, Algeria.

Characters.—Colour pale yellow when recent, odour strong and disagreeable, and having a bitter, acrid taste.

Chemistry, etc.—S.G. 0·835 to 0·840; slightly dextro-rotatory. Consists of a mixture of aldehydes and ketones, chiefly *methylnonyl-ketone*,

$CH_3.CO.C_9H_{19}$, and consequently, should be converted into a solid crystalline mass when treated with a hot solution of sodium bisulphite. The Algerian oil has been shown to contain about 40 per cent. of *methylheptyl-ketone* in addition to methylnonyl-ketone. The alcohols *methylheptyl-carbinol* and *methylnonyl-carbinol*, with their acetic esters, are also present in this variety.

Uses, etc.—As stimulant and antispasmodic; also externally as rubefacient. *Dose.*—1 to 4 minims.

OLEUM COPAIBÆ.—Oil of Copaiba.—The oil distilled from Copaiba.

B.P. Characters and Tests.—Colourless or pale yellow, with the odour and taste of copaiba. S.G. 0·900 to 0·910. It turns the plane of a ray of polarised light to the left, and is soluble in its own volume of absolute alcohol (distinction from African copaiba oil).

Chemistry, etc.—Mainly composed of *caryophyllene* $C_{15}H_{24}$, a sesquiterpene, also contained in oil of cloves. Copaiba oil distils between 250° and 275°, has optical rotation, −7° to −35°, and is soluble with difficulty in 90 per cent. alcohol.

Uses, etc.—Similar to those of the oleo-resin. *Dose.*—5 to 20 minims.

OLEUM ROSÆ.—Oil of Rose.—The oil distilled from the fresh flowers of Rosa damascena, *Linn.* [*Redouté, Les roses*, plate 109].

N.O.—Rosaceæ.

Syns.—Otto of Rose, Attar.

Habitat.—Bulgaria, Roumania, and other parts of Southern Europe, also Persia and India.

B.P. Characters and Test.—A pale yellow crystalline semi-solid, with the strong fragrant odour of rose and a sweet taste. S.G. 0·856 to 0·860 at 86° F. (30° C.) The congealing and melting points vary according to the proportion of crystalline matter, but should lie between 67° and 70° F. (19·4° and 22·2° C.)

Chemistry, etc.—Oil of rose consists of a mixture of a liquid oxygenated portion (80 to 90 per cent.) and a solid hydrocarbon, or mixture of hydrocarbons (10 to 20 per cent.), belonging to the paraffin series and known as stearoptene. The chief constituent of the liquid portion is the alcohol *geraniol* $C_{10}H_{18}O$; *citronellol* $C_{10}H_{20}O$ is present to the extent of about 30 to 40 per cent., together with small amounts of esters of both these alcohols. *Phenyl-ethyl alcohol* and traces of other substances have also been isolated. *Rhodinol* and *roseol*, so-called, were probably impure geraniol.

Note.—About 3,000 lbs. of rose-petals are needed for the production of 1 lb. of otto, this fact rendering the oil very expensive and therefore very liable to adulteration. The commonest adulterant is palmarosa oil [Turkish Geranium oil from Cymbopogon

martini *Stapf.* (Andropogon schœnanthus)]; Oil of Rose Geranium (from Pelargonium species, *N.O.*—Geraniaceæ), guaiacum wood oil, santal oil, etc., have also been used. Unless the oil has been crudely adulterated, chemical tests for its purity are of little value, and the sense of smell is ultimately the most valuable means of arriving at the value of otto.

OLEUM EUCALYPTI—Oil of Eucalyptus.

—The oil distilled from the fresh leaves of Eucalyptus globulus, *Labill.* [*Bentl. and Trim. Med. Pl.* vol. ii. plate 109], and other species of Eucalyptus.

N.O.—Myrtaceæ.

Habitat.—Australia, Tasmania; cultivated in Algeria, etc.

B.P. Characters and Tests.—Colourless or pale-yellow, having an aromatic camphoraceous odour, and a pungent taste, leaving a sensation of coldness in the mouth. S.G. 0·910 to 0·930. It should not rotate the plane of a ray of polarised light more than 10° in either direction in a tube 100 millimetres long, and it should become semi-solid on being stirred, when cold, with a third or half its volume of phosphoric acid of commerce of S.G. 1·750 (presence of a due proportion of cineol). If to 1 cubic centimetre of the oil there be added 2 cubic centimetres of *glacial acetic acid* and 2 cubic centimetres of a saturated aqueous solution of *sodium nitrite*, the mixture, when gently stirred, should not form a crystalline mass (exclusion of eucalyptus oils containing much phellandrene).

Chemistry.—The eucalyptus oils which answer the official tests contain a large proportion of *cineol* (eucalyptol), but what actual percentage the B.P. test requires is unknown; 50 per cent. may be taken as a satisfactory value. From these oils on the other hand the terpene *phellandrene* must be absent, or present only in very small quantity. The globulus oil has a S.G. of 0·910 to 0·930, is dextro-rotatory from 1° to 10°, and contains in addition to from 50 to 60 per cent. of cineol, the terpenes *limonene* and *pinene*, *cymene* and traces of aldehydes.

Eucalyptol (cineol), $C_{10}H_{18}O$, is obtainable from the globulus and certain other eucalyptus oils by treatment with syrupy phosphoric acid, an insoluble *eucalyptol phosphate* being formed, which water resolves into its components. It may also be obtained fairly pure by fractional distillation —(B.P. 176° C.). It has S.G. 0·930, is optically inactive, and solidifies at 2° C. Eucalyptol is regarded as the therapeutically important constituent of eucalyptus oil, and the eucalyptol content of the oil is, for that reason, taken as a standard of quality. Eucalyptol itself is included in both the B.P.C. and U.S.P.

Uses, etc.—As antiseptic and deodorizer; has been much used as a preventive in epidemic influenza. *Dose.*—$\frac{1}{2}$ to 3 minims.

B.P. Preparation.

Unguentum Eucalypti.

Note.—The genus Eucalyptus includes a large number of species mostly indigenous to Australia and usually bearing leaves yielding essential oil. The divergence in the chemical characters of the oils obtained from the different species is very marked and is shown in the table which includes the more important of the eucalyptus oils which have been examined.

VARIETIES OF EUCALYPTUS OIL.

Botanical name of tree.	*Specific gravity of oil.*	*Percentage of cineol (eucalyptol).*	*Other important constituents.*	*Remarks.*
E. AMYGDALINA ..	0·855 to 0·890	5 to 20 ..	Phellandrene .. .. (considerable).	Victorian "narrow-leaved peppermint." One of the biggest trees known.
E. BAILEYANA	0·890 to 0·920	25 to 30 ..	Phellandrene, citral ..	A "stringy bark" tree of N.S.W.
E. CNEORIFOLIA ..	0·915 to 0·925	50 to 70 ..	Pinene, aromadendral ..	"Narrow-leaved eucalyptus" of Kangaroo Island. One of the Mallees.
E. DEALBATA	0·885 to 0·900	Large	Pinene	.. ..
E. DUMOSA	0·900 to 0·912	30 to 50 ..	Aromadendral, terpenes..	One of the Mallees.
E. HÆMOSTOMA ..	0·880 to 0·890	.. .. ..	Phellandrene, sesquiterpene	One of the "white gums" of N.S.W.
E. CITRIODORA	0 870 to 0·905	.. .. ..	Citronellal (much) ..	The "citron-scented" eucalyptus of the Queensland coast.
E. ODORATA	0·900 to 0·925	.. .. ..	Phellandrene, aromadendral	The white box tree of South Australia.
E. OLEOSA	0 905 to 0·930	Large	Aromadendral, pinene ..	One of the Mallees. This oil must be distinguished from that of E. cneorifolia, which affords much of the Oleosa oil of commerce.
E. PUNCTATA	0·912 to 0·920	46 to 64 ..	Pinene	The "grey gum" tree of N.S.W.
E. ROSTRATA	0·918 to 0·930	Small	Aromadendral, terpenes..	A "red gum" tree, much used for timber.
E. RISDONI	0·910 to 0 925	Large	Phellandrene, piperitone	.. ..
E. STAIGERIANA ..	0·870 to 0·880	.. .. ..	Citral, limonene, geraniol	The "lemon-scented iron-bark tree" of Queensland.
E. MACARTHURI ..	0·925	.. .. ..	Geranyl acetate .. .. (60 to 70 per cent.)	"Paddy's river box" tree.

OLEUM CARYOPHYLLI.—Oil of Cloves.

—The oil distilled from Cloves.

B.P. Characters and Tests.—Colourless or pale yellow when recent but gradually becoming reddish-brown, having the strong odour and taste of cloves. S.G. not below 1·050. An alcoholic solution yields a blue colour with test-solution of ferric chloride. Shaken with its own volume of strong solution of ammonia it forms a semi-solid yellowish mass.

Chemistry, etc.—The phenol, *eugenol* $C_{10}H_{12}O_2$ is the chief constituent of the oil and should be present to the extent of 80 to 90 per cent. Oil of Cloves also contains the sesquiterpene *caryophyllene* and small proportions of *furfurol*, *methyl-amyl ketone*, *vanillin*, *etc.*

Eugenol may be determined by shaking the oil with 5 per cent. aqueous solution of potassium hydroxide and measuring the residual oil, the difference between this volume and the original gives an approximate figure for the amount of eugenol present. Eugenol is official in the B.P.C. and in the United States and German Pharmacopœias.

Uses.—Aromatic stimulant and carminative, flavouring agent. *Dose.*—½ to 3 minims.

OLEUM PIMENTÆ.—Oil of Pimento.—

The oil distilled from Pimento.

B.P. Characters and Tests.—Yellow or yellowish-red when recently distilled, but gradually becomes darker. It has the odour and taste of Pimento. S.G. not below 1·040. It should be converted into a semi-solid mass when shaken with an equal volume of strong solution of ammonia.

Chemistry, etc.—Oil of Pimento contains *eugenol*; a sesquiterpene and other undetermined constituents which modify the odour of the oil and render it distinct from clove oil. Eugenol should be present to the extent of 65 per cent. and may be determined by the method described under oil of cloves.

Uses.—Similar to those of oil of cloves. *Dose.*—½ to 3 minims.

OLEUM CAJUPUTI.—Oil of Cajuput.—

The oil distilled from the leaves of Melaleuca Leucadendron, *Linn.* (Melaleuca Cajuputi, *Roxb.*) [*Bentl. and Trim. Med. Pl.* vol. ii. plate 108].

N.O.—Myrtaceæ.

Habitat.—Molucca Islands; imported from Macassar, Batavia and Singapore.

B.P. Characters and Tests.—Bluish-green, with an agreeable penetrating camphoraceous odour, and an aromatic bitterish camphoraceous taste. S.G. from 0·922 to 0·930. It should become semi-solid on being stirred, when cold, with a third or half its volume of phosphoric acid of commerce of S.G. 1·750 (presence of a due proportion of cineol).

Chemistry, etc.—The chief constituent of the oil is *cineol* (*cajuputol*, *eucalyptol*) $C_{10}H_{18}O$, which should be present to the extent of 55 to 65 per cent). *Terpineol* $C_{10}H_{17}OH$ a solid crystalline alcohol, together with its acetic ester; *pinene* and aldehydic bodies are also present. The oil is wholly soluble in alcohol. It has been found to contain traces of copper which give it a permanent green tint, but its natural green colour is probably due to a chlorophyll-like compound. Cineol may be detected and estimated by the same tests as are applied to oil of eucalyptus (*q.v.*).

Uses, etc.—Internally as powerful stimulant and diaphoretic. Externally as liniment in rheumatism, etc. *Dose.*—½ to 3 minims.

B.P. Preparations.
Linimentum Crotonis.
Spiritus Cajuputi.

Note.—Oils similar to that of Cajuput are obtained from other species of Melaleuca *e.g.*, M. HYPERICIFOLIA, M. VIRIDIFOLIA, M. LATIFOLIA, etc., and numerous Australian species have been described, *e.g.*, M. DECUSSATA, M. ERICIFOLIA, etc.

OLEUM CARUI.—Oil of Caraway.

—The oil distilled from Caraway fruit.

B.P. Characters.—Colourless or pale yellow, with the characteristic odour of the fruit and a spicy taste. S.G. 0·910 to 0·920.

Chemistry.—The oil contains *carvone* ($C_{10}H_{14}O$) 50 to 60 per cent. and the terpene, *dextro-limonene* (*carvene* $C_{10}H_{16}$). Carvone, which is a ketone, is the valuable constituent, and is found also in oils of dill and cumin. Caraway oils of low S.G. are sold, but such oils have been deprived of the bulk of the carvone.

Uses, etc.—As a carminative. *Dose.*—½ to 3 minims.

OLEUM CORIANDRI.—Oil of Coriander.

—The oil distilled from Coriander fruit.

B.P. Characters and Test.—Colourless or pale yellow, having the odour and flavour of the fruit. S.G. 0·870 to 0·885. If 1 cubic centimetre of the oil be mixed with 3 cubic centimetres

of alcohol (70 per cent.), a clear solution results (absence of oil of turpentine and added terpenes).

Chemistry, etc.—The alcohol *coriandrol* $C_{10}H_{18}O$, forms the greater part of the oil (about 90 per cent.) pinene is also present, and probably other undetermined bodies. Coriandrol is a dextrogyrate modification of linalool, and like it, yields citral on oxidation. Coriander oil should have a rotation of $+8°$ to $+13°$.

Uses, etc.—As flavouring agent and stimulant carminative. *Dose.*—½ to 3 minims.

Note.—The commercial oil is mainly distilled from the ripe fruit from Moravia, Thuringia and Russia, these varieties yielding about 1 per cent. of oil. Oil distilled from unripe fruit has a highly disagreeable odour, and a low specific gravity.

OLEUM ANISI.—Oil of Anise.—The oil distilled from Anisi Fruit, or from the fruit of the Star-anise.

B.P. Characters and Tests.—Colourless or pale yellow; with the odour of the fruit and a mildly aromatic taste. It congeals when stirred, at temperatures between 10° and 15° C. and should not again become liquid below 15° C. S.G. at 20° C. 0·975 to 0·990. It rotates the plane of a ray of polarised light slightly to the left.

Chemistry, etc.—The principal constituent of both European and Chinese oil of anise is *anethol* ($C_{10}H_{12}O$), which, on oxidation by age, etc., becomes converted into anisic aldehyde and anisic acid. Both Pimpinella oil and that from Star-anise contain *methyl chavicol*, while lævo-phellandrene, pinene, etc., have been detected in the latter.

Anise oil is soluble in three parts of 90 per cent. alcohol, and in all proportions of absolute alcohol. The European oil may be distinguished from the oil obtained from Star-anise by giving a deep-blue colour on the addition of saturated solution of hydrochloric acid gas in alcohol.

The oil may be adulterated with petroleum, fennel oil, anise oil partly deprived of anethol, etc. Petroleum is indicated by insolubility in alcohol, fennel oil by the occurrence of dextro-rotation however slight, and the proportion of anethol present is indicated by the congealing point.

Uses.—As a flavouring agent, also as carminative and expectorant. *Dose.*—½ to 3 minims.

OLEUM ANETHI.—Oil of Dill.—The oil distilled from Dill Fruit.

B.P. Characters and Test.—Colour pale yellow, odour that of the fruit, taste sweet and aromatic. S.G. 0·905 to 0·920. It

rotates the plane of a ray of polarised light not less than 70° to the right at 15·5 C. in a tube 100 mm. long.

Chemistry, etc.—In constitution oil of dill is similar to oil of caraway, consisting of terpenes, chiefly *limonene*, with *carvone*, the latter in slightly less proportion than is found in caraway oil.

Uses.—Carminative. *Dose.*—½ to 3 minims.

Note.—East Indian Dill oil, from *Peucedanum Sowa*, has S.G. 0·945 to 0·970 owing to the presence in it of "*dill apiol.*"

OLEUM ANTHEMIDIS.—Oil of Chamomile.

—The oil distilled from Chamomile flowers.

B.P. Characters.—Pale blue or greenish-blue when freshly distilled, but gradually becoming yellowish-brown. It should have the aromatic taste and odour of the flowers. S.G. 0·905 to 0·915.

Chemistry, etc.—An alcohol *anthemol* and a paraffin *anthemene* are present, but the bulk of the oil consists of a mixture, in varying proportions, of *angelates* and *tiglates* of *amyl* and *butyl* alcohol and probably other esters.

Uses.—Carminative. *Dose.*—½ to 3 minims.

OLEUM ROSMARINI.—Oil of Rosemary.

—The oil distilled from the flowering tops of Rosmarinus officinalis, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 207].

N.O.—Labiatæ.

Habitat.—Europe.

B.P. Characters and Tests.—Colourless or pale yellow, with the odour of rosemary, and a warm camphoraceous taste. S.G. 0·900 to 0·915. It should dissolve in twice its volume of alcohol (90 per cent.), and should not rotate the plane of a polarised ray of light more than 10° to the right in a tube 100 millimetres long (absence of oil of turpentine).

Chemistry.—Contains *dextro-pinene*, *camphene*, *cineol*, *borneol*, and *camphor*, with a small quantity of esters.

Uses, etc.—Stimulant, but rarely given internally. *Dose.*—½ to 3 minims. Used externally as rubefacient.

B.P. Preparations.

Linimentum Saponis.
Spiritus Rosmarini - - - - 1 volume in 10.
Tinctura Lavandulæ Compositæ.

Note.—Adulteration with oil of turpentine may also be detected by the low borneol percentage given after esterification by treatment with acetic anhydride. The greater part of the oil of commerce is derived from France and Italy, Spain and England produce comparatively unimportant proportions.

OLEUM LAVANDULÆ—Oil of Lavender.

—The oil distilled from the flowers of Lavandula vera, *DC.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 199].

N.O.—Labiatæ.

Habitat.—France, Italy and Britain (cultivated).

B.P. Characters and Tests.—Pale yellow or nearly colourless, with the fragrant odour of the flowers, and a pungent bitter taste. S.G. not below 0·885. It should dissolve in three times its volume of *alcohol* (70 per cent.).

Chemistry.—English lavender oil contains the alcohol *linalool* ($C_{10}H_{18}O$). There are also present from 7 to 10 per cent. of *linalyl acetate*, *cineol*, traces of *limonene*, of *geraniol*, and of a sesquiterpene.

French Oil of Lavender is much richer in ester (linalyl acetate) than that distilled from English-grown plants, but in spite of this the latter is universally recognised as being from five to ten times more valuable. The best French oils contain from 30 to 40 per cent. of linalyl acetate, together with free linalool and geraniol, but only traces of cineol. It is interesting to note that cuttings of English plants grown on the Continent produce an oil differing in no way from the French oil of commerce.

Uses, etc.—As aromatic stimulant and carminative, usually in conjunction with other medicines. *Dose.*—½ to 3 minims.

B P. Preparations.

Linimentum Camphoræ Ammoniatum.	
Spiritus Lavandulæ - - - -	1 volume in 10.
Tinctura Lavandulæ Composita - -	1 in 213, about.

Oil of Spike Lavender, from LAVANDULA SPICA, has S.G. 0·905 to 0·918, is dextro-rotary, contains from 30 to 40 per cent. of alcohols (linalool, etc.), together with *pinene*, *cineol*, *camphor*, and *borneol*. Turpentine and cheap rosemary oils (possibly) are used for adulterating oil of spike, and this oil itself is frequently added to lavender oil for the same purpose.

Synthetic esters have also been used to increase the apparent percentage of linalyl acetate in French oils.

OLEUM MENTHÆ PIPERITÆ.—Oil of Peppermint.

—The oil distilled from fresh flowering peppermint, Mentha piperita, *Sm.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 203].

N.O.—Labiatæ.

Habitat.—Britain, United States of America, etc.

B.P. Characters and Tests.—Colourless, pale yellow, or greenish-yellow when recently distilled, but gradually becoming darker by age. It has the odour of the herb, and a strong

penetrating aromatic taste, followed by a sensation of coldness in the mouth. S.G. 0·900 to 0·920. It should dissolve in four times its volume of *alcohol* (70 per cent.). If a portion of the oil be cooled to 17° F. (—8·3 C.) and a few crystals of menthol be added, a considerable separation of menthol should take place.

The Pharmacopœia formerly required the oil distilled in Britain, but this is no longer necessary. English oil is however still by far the most valuable variety.

Chemistry.—Oil of peppermint contains several bodies, including *menthol* ($C_{10}H_{20}O$) and small quantities of *menthol esters* (*acetic* and *isovaleric*) and of *menthone* ($C_{10}H_{18}O$). The most important constituent is menthol or *peppermint camphor*, a solid alcohol possessing the characteristic odour and taste of the oil. A chemical method of determining the percentage of menthol is based upon the formation of menthyl acetate when the oil is treated with acetic anhydride, the ester being subsequently hydrolysed and the resulting acetic acid determined. The total menthol content of Mitcham oil is from 55 to 70 per cent., part of which (4 to 5 per cent. or more) is present as esters.

Uses, etc.—Internally as aromatic, stimulant and carminative. *Dose.*—½ to 3 minims. Externally in tic and allied complaints.

B.P. Preparations.

Aqua Menthæ Piperitæ - - - 1 in 1000, about.
Pilula Rhei Composita.
Spiritus Menthæ Piperitæ - - - 1 in 10.
Tinctura Chloroformi et Morphinæ Composita.

Note.—Varieties of Peppermint Oil.—*American Oil of Peppermint* is distilled from M. piperita and has a somewhat higher average S.G. than the English oil; the percentage of menthol present is usually somewhat smaller, that of ester higher, and the aroma inferior. American oil has been exhaustively analysed, and is stated to contain—in addition to the bodies found in English oil—pinene, limonene, phellandrene, cineol, acetaldehyde, a lactone, etc. *Japanese Oil of Peppermint* is distilled from M. arvensis *var.* piperascens et glabrata, the S.G. is generally low—0·895 to 0·905—and the menthol content high, being sometimes as much as 90 per cent., the normal oil forming a mass of crystals at ordinary temperatures; the oil usually styled Japanese oil of peppermint is partly dementholized. This variety of oil is inferior in aroma and taste to both English and American oil.

Ordinary adulterations can be detected by observing the solubility of the oil in 70 per cent. alcohol and by determining the amount of menthol, free and combined. Adulteration of high priced oils with those of lower grade can only be distinguished by odour and taste.

MENTHOL.—**Menthol.**—A crystalline substance, $C_6H_9.OH.CH_3.C_3H_7$, obtained by cooling the oil distilled from the fresh herb of Mentha arvensis, *D.C. vars.* piperascens et glabrata, *Holmes;* and of Mentha piperita, *Sm.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 203].

N.O.—Labiatæ.

Habitat.—Japan and China.

B.P. Characters and Tests.—In colourless acicular crystals usually more or less moist from adhering oil; or in crystalline masses. Melting point 107·6° F. (42° C.); it should not exceed 109·4° F. (43° C.). It has the odour and flavour of peppermint, producing a sensation of warmth on the tongue, and, if air is inhaled, a sensation of coolness. It is very slightly soluble in *water*, but readily soluble in *alcohol* (90 per cent.), the solutions having a neutral reaction. Boiled with *sulphuric acid* diluted with half its volume of *water*, menthol acquires an indigo-blue or ultramarine colour, the acid becoming brown. It should be entirely volatilised by the heat of a water-bath.

Note.—Menthol is obtained almost exclusively from the Japanese oil which is distilled from the two varieties of M. arvensis; it is obtained by placing the oil in wooden refrigerators and using the artificial cold of ice and salt if found to be necessary. A yield of 20 per cent. of menthol only alters the gravity of the oil $\frac{1}{1000}$ of its original density.

Chemistry, etc.—Menthol, $C_6H_9OHCH_3C_3H_7$, belongs to the class of camphors and chemically possesses the characters of an alcohol. It is lævo-rotatory (about —60°), forms esters with acids and readily parts with water. With concentrated hydrochloric acid it forms a liquid *menthol chloride*, $C_{10}H_{19}Cl$, and when distilled with P_2O_5 gives *menthene* $C_{10}H_{18}$, by the oxidation of which menthone, $C_{10}H_{18}O$, is formed. It may be obtained from menthone, to which it stands in the relation of alcohol to ketone, by reduction.

Uses, etc.—As local application in neuralgia, etc., much used in the form of cones, pencils, etc. When given internally, *dose*—$\frac{1}{2}$ to 2 grains.

B.P.C. Preparation.—Gossypium Mentholis.

OLEUM MENTHÆ VIRIDIS.—Oil of Spearmint.

—The oil distilled from fresh flowering spearmint, Mentha viridis, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 202].

N.O.—Labiatæ.

Habitat.—Britain, United States of America, etc.

B.P. Characters and Test.—Colourless, pale yellow, or greenish-yellow when recently distilled, but becoming darker by age. It has the odour and taste of the herb. S.G. 0·920 to 0·940. The oil forms a clear solution with its own volume of a mixture of equal parts of *absolute alcohol* and *alcohol* (90 per cent).

Chemistry.—Contains a *terpene* $C_{10}H_{16}$ and *lævo-carvone* ($C_{10}H_{14}O$). The latter is present to the extent of from 35 to 55 per cent. in American oil.

Uses, etc.—For the same purpose as oil of peppermint. *Dose.*—$\frac{1}{2}$ to 3 minims.

B.P. Preparation.

Aqua Menthæ Viridis - - - 1 part in 1000, about.

VARIETIES OF MINT OILS.—*Russian Oil of Spearmint* is distilled probably not from M. viridis. It has S G. 0·885, contains lævo-carvone (5 to 10 per cent.), *lævo-linalool* (50 to 60 per cent.), *cineol* and *lævo-limonene*.

Horsemint Oil, from Monarda punctata, is dextro-rotary, has S.G. 0·930 to 0·940, and contains in addition to terpenes, *cymene*, *thymol*, and probably *linalool*.

Pennyroyal Oil (*see* page 131).

THYMOL.—Thymol.—A crystalline substance, $C_6H_3.OH.CH_3.C_3H_7$, obtained from the volatile oils of Thymus vulgaris, *Linn.*, *N.O.*—Labiatæ; Monarda punctata, *Linn.*, *N.O.*—Labiatæ; and Carum copticum, *Benth. and Hook. f.*, *N.O.*—Umbelliferæ [*Bentl. and Trim. Med. Pl.* vol. iii. plates 205 and 208, and vol. ii. plate 120]. Purified by recrystallisation from alcohol.

Habitat.—Britain, South of France, etc.

B.P. Characters and Tests.—Large oblique prismatic crystals, having the odour of thyme and a pungent aromatic taste. They sink in cold water, but on heating the mixture to a temperature of 110° to 125° F. (43·3° to 51·7° C.) they melt and rise to the surface. Almost insoluble in cold *water*, freely soluble in *alcohol* (90 per cent.), *ether*, and solutions of alkalies. The crystals volatilise completely at the temperature of a water-bath. A solution of thymol in half its bulk of *glacial acetic acid*, warmed with an equal volume of *sulphuric acid*, assumes a reddish-violet colour.

Note.—Thymol is present to the extent of about 20 to 60 per cent. in the oils which yield it. Its purification is effected by treating the oil (first deprived by distillation of its fractions of lower boiling point) with warm solution of sodium hydroxide; the alkali dissolves the thymol, and on dilution with hot water the undissolved oil (terpenes, etc.) rises to the surface. The soda-thymol is decomposed by treatment with hydrochloric acid and subsequent crystallization of the oily layer.

Chemistry.—Thymol, or *methyl-propyl phenol* (for graphic formula *see* page 263), has been prepared synthetically. When treated with caustic potash and iodine yields *iodo-thymol* ("aristol" or "annidalin").

Uses, etc.—As deodorant, etc. *Dose.*—½ to 2 grains. Is a highly powerful antiseptic.

OLEUM PATCHOULI.—Oil of Patchouli.—The volatile oil obtained by distillation from the leaves of Pogostemon Patchouli, *Pelletier* and other species.

N.O.—Labiatæ.

Habitat.—Phillipines, the Malay Peninsula, etc.

Characters, Chemistry, etc.—Thick, brownish-yellow, with a green tint. S.G. 0·975 to 0·995; boiling at 257° C. It contains a stearoptene (*patchouli alcohol* or *camphor*, $C_{15}H_{26}O$) *cærulein*, found also in oil of wormwood and other oils, and cadinene ($C_{15}H_{24}$). It is said to be adulterated with

cubeb and cedar oils, and the body to which it owes its odorous quality has not been isolated.

Uses, etc.—In perfumery.

Note.—The herb cultivated in Assam is not genuine patchouli, but is derived from Microtæna cymosa, *Prain*, and gives an inferior oil.

OLEUM CUBEBÆ.—Oil of Cubebs.—The oil distilled from Cubebs.

B.P. Characters.—Colourless, pale-green or greenish-yellow; with the odour and camphoraceous taste of cubebs. S.G. 0·910 to 0·930.

Chemistry, etc.—Oil from fresh cubebs consists practically entirely of terpenes and sesquiterpenes. *Cubeb camphor* $C_{15}H_{25}OH$, probably an alcohol, occurs only in oil distilled from old cubebs.

Uses.—As stimulant and antiseptic in diseases of the mucous membranes. *Dose.*—5 to 20 minims.

OLEUM MYRISTICÆ.—Oil of Nutmeg.

The oil distilled from Nutmeg.

B.P. Characters and Tests.—Colourless or pale yellow, having the odour and taste of nutmeg. S.G. 0·870 to 0·910. The oil forms a clear solution with its own volume of a mixture of equal parts of absolute alcohol and alcohol (90 per cent.). A little evaporated on a water-bath should not yield a residue which crystallizes on cooling (absence of the concrete oil of nutmeg).

Chemistry, etc.—The oil consists of terpenes, *pinene*, *camphene* and *dipentene*, together with the alcohols *linalool*, *borneol*, *terpineol* and *geraniol*; *myristicin* $C_{11}H_{12}O_3$, *myristic acid* and *eugenol*, *safrol*, etc.

The name "myristicol" was applied to a mixture of the alcoholic constituents.

Uses.—As aromatic carminative and flavouring agent. *Dose.*—$\frac{1}{2}$ to 3 minims.

Note.—Oil of mace is the essential oil distilled from the mace or arillus of the nutmeg, it closely resembles oil of nutmeg but contains a larger proportion of oxygenated constituents.

OLEUM CINNAMOMI.—Oil of Cinnamon.

The oil distilled from Cinnamon Bark.

Syn.—Oil of Cinnamon.

B.P. Characters and Tests.—Yellow, when freshly distilled, but gradually becoming reddish; having the odour and taste of the bark. S.G. 1·025 to 1·035. 1 cubic centimetre dissolved in 5 cubic centimetres of alcohol (90 per cent.), and test-solution of ferric chloride added, should afford a pale-green,

but not a decided blue colouration (absence of cinnamon-leaf oil). If 10 cubic centimetres be well shaken with 50 cubic centimetres of a boiling 30 per cent. solution of sodium hydrogen sulphite, an oily layer separates which when cooled to 15·5° C, should not measure more than 5 cubic centimetres (absence of more than 50 per cent. of constituents other than aldehydes).

Chemistry, etc.—The chief constituent is *cinnamic aldehyde* $C_6H_5.CH.CH.CHO$, which should be present to the extent of at least 65 per cent. but not more than 75 per cent. The oil also contains small proportions of eugenol and of a terpene.

Common adulterants are oil of cinnamon-leaf, oil of cassia and synthetic cinnamic aldehyde; the former can be detected by the diminution in the percentage of aldehyde and increase in that of eugenol present. Oil of Cassia and the synthetic aldehyde increase the S.G. and aldehyde content, but a mixture of these and cinnamon-leaf oil would be best detected by the odour and the ferric chloride test.

Uses.—Mainly as a flavouring agent and as an antiseptic.

Note.—Cinnamon leaf and cinnamon root oils are different from that obtained from the bark. The leaf oil consists almost entirely of eugenol, with a small proportion of terpene and cinnamic aldehyde, while the oil obtained from the root contains eugenol with large quantities of terpene and safrol and a trace of benzaldehyde. The U.S.P. Oil of Cinnamon is derived from Cassia Cinnamon (Oil of Cassia).

CAMPHORA.—Camphor.—A white crystalline substance obtained from Cinnamomum Camphora, *Nees and Eberm.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 222], purified by sublimation.

N.O.—Lauraceæ.

Syn.—Japan Camphor.

Habitat.—China, Formosa, Japan.

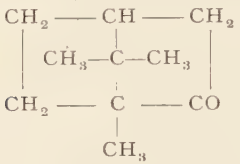
B.P. Characters.—In solid, colourless, transparent, crystalline pieces of tough consistence; also in rectangular tablets or in pulverulent masses known as 'flowers of camphor.' S.G. about 0·995. It has a powerful penetrating odour, and a pungent somewhat bitter taste, followed by a sensation of cold. It burns readily with a bright smoky flame, volatilises even at ordinary temperatures, and sublimes without residue when heated; it is soluble in about 700 parts of *water*, in about 1 part of *alcohol* (90 per cent.), in one quarter part of *chloroform*, and in 4 parts of *olive oil*; very soluble in *ether*. It forms a liquid when triturated with chloral hydrate, menthol, phenol, or thymol.

Method of Production, etc.—The root and base of the trunk are used in the production of camphor although that substance occurs in all parts of the tree. The wood thus obtained is cut into chips and distilled by blowing steam through it; the first distillate consists of oil and water, afterwards camphor distils over and is collected into a fresh receiver forming the crude camphor of commerce. The crude camphor is refined by mixing with lime and subliming; if the vapours are allowed to

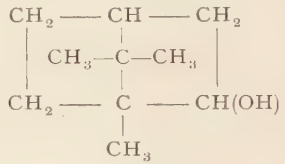
condense in a large heated chamber the camphor takes the pulverulent form of "flowers," otherwise "bells" are produced of a semi-crystalline character.

Chemistry, etc.—Chemically camphor is known as *laurinol*, $C_{10}H_{16}O$; it is the ketone of Borneo camphor $C_{10}H_{18}O$ (*borneol*). By treatment with phosphorus pentoxide it is converted into cymene, and on boiling with iodine yields carvacrol ($C_{10}H_{14}O$). On oxidation with nitric acid, *camphoric* and *camphoronic* acids are obtained. It may be produced artifically in several ways (*v. infra*).

Note.—The following formulæ may be taken as indicating the relationship of camphor and borneol to one another (the formula for camphor is that of Bredt.).



CAMPHOR.



BORNEOL.

Uses, etc.—As stimulant, antispasmodic and diaphoretic; in large doses sedative. *Dose.*—2 to 5 grains.

B.P. Preparations.

Aqua Camphoræ - - - - 1 part in 1000.
Linimentum Aconiti.
,, Belladonnæ.
* ,, Camphoræ - - 1 part in 5, nearly.
† ,, ,, Ammoniatum 1 ,, 8.
,, Saponis.
,, Sinapis.
,, Terebinthinæ.
Spiritus Camphoræ - - - 1 part in 10.
Tinctura Camphoræ Composita - 1 ,, 320, nearly.
Unguentum Hydrargyri Compositum.

**Used in preparing*
Linimentum Chloroformi, Linimentum Hydrargyri, and Linimentum Terebinthinæ Aceticum.

†*Used in preparing*
Linimentum Opii.

Preparations of the B.P.C.—Camphor. c. Creta (1 in 10), Camphor. Monobrom. (*v. infra.*), Chloral Camphoratum, Camphor. c. Cocaina, Chloroformum Camphoratum and Essentia Camphoræ (Rubini's).

Large quantities of camphor are used in the preparation of celluloid, which is an intimate mechanical mixture of pyroxylin and camphor, formed by partially dissolving each substance in a suitable solvent, mixing and subjecting to pressure.

Note.—Borneo Camphor, Sumatra Camphor (*borneol*) $C_{10}H_{18}O$, is found in fissures of the tree DRYOBALANOPS AROMATICA (*N.O.*—Dipterocarpaceæ), indigenous to Sumatra and Borneo. Borneo camphor differs from ordinary camphor in having a higher S.G. (1·009), being less volatile and having a distinctive odour. It is highly prized by the Chinese, by whom it is used for embalming purposes. Borneo may be converted into ordinary camphor by treatment with nitric acid. (*See* graphic formulæ above).

Ngai or *Blumea Camphor* has the composition of Borneo camphor, and is obtained from BLUMEA BALSAMIFERA (*N.O.*—Compositæ. *Habitat.*—Tropical Eastern Asia).

Synthetic or *Artificial Camphor* is the subject of a number of patents and is now produced on a large scale, most of the output being absorbed in the celluloid industry. Pinene obtained from oil of turpentine is the starting point of most of the patented processes, from this, borneol is obtained by a variety of methods and is oxidised by potassium permanganate, chlorine, etc., into ordinary camphor. An interesting method of obtaining borneol from pinene is by the interaction of pinene hydrochloride and a metallic acetate giving iso-borneol acetate, saponification of this compound gives iso-borneol. Synthetic camphor differs from the natural variety in possessing no action on a ray of polarised light. One, at least, of the brands obtainable has a very distinct terebene-like odour easily distinguishable from that of ordinary camphor.

Oil of Camphor.—Japanese Oil of Camphor is the oil obtained in the preparation of crude camphor and in refining it (*vide supra*). It is colourless or yellow in colour, has a camphoraceous odour, and its S.G. may vary from 0·880 to 1·000 according to composition. The lighter oils consist almost entirely of terpenes, the heavier samples contain varying proportions of *safrol, eugenol, terpineol*, etc. Safrol is the most valuable constituent and heavy oils occur from which this has been entirely removed.

Oil of Borneo Camphor from young trees of Dryobalanops aromatica is a reddish or greenish oil, of S.G. 0·900 consisting largely of hydrocarbons, *borneene* so called, has been shown to be a mixture of hydrocarbons.

Camphora Monobromata, B.P.C. and U.S.P., $C_{10}H_{15}BrO$, is prepared by the action of bromine on camphor. It is obtained in prismatic scales or needles, having a camphoraceous odour and taste, insoluble in water, soluble in alcohol, ether and chloroform. It is used as a sedative and hypnotic.

OLEUM SANTALI.—Oil of Sandal Wood.

—The oil distilled from the wood of Santalum album, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 252].

N.O.—Santalaceæ.

Syn.—Oil of Santal Wood.

Habitat.—India, etc.

B.P. Characters and Tests.—Somewhat viscid in consistence, pale yellow in colour, having a strongly aromatic odour and a pungent and spicy taste. S.G. 0·975 to 0·980. It forms a clear solution with six times its volume of *alcohol* (70 per cent.) (absence of cedar wood oil). It rotates the plane of a ray of polarised light to the left, through an angle of not less than 16° and not more than 20°, in a tube 100 millimetres long (absence of other varieties of sandal wood oil).

Chemistry.—Contains upwards of 90 per cent. of *santalol* ($C_{15}H_{26}O$), which is regarded as a mixture of two alcohols, the one dextro- the other lævo-rotary. Santalol is lævo-rotary about —18°; has S.G. about 0·980.

Uses, etc.—In gonorrhœa, etc. *Dose.*—15 to 50 minims, usually given in capsules or emulsion.

Note.—West Indian Sandal Wood Oil is not a true Santal oil but is derived from Amyris balsamifera (*N.O.*—Burseraceæ). It is dextro-rotary and on acetylation has been found to contain about 50 per cent. of alcohols of unknown identity. It has been recently stated that fractional distillates of this oil have been used as adulterants of the

official oil. West Australian santal oil from Santalum cygnorum is dextro-rotary and differs considerably from the East Indian oil, it contains about 75 per cent. of alcohols but it is doubtful whether these correspond to the alcohols of S. album. S. preissianum of South Australia gives an oil differing entirely from that obtained from other species. African santal oil (S.G. about 0·965) is of untraced botanical origin. The Fiji santal oil is obtained from S. Yasi; it has S.G. of about 0·976.

Adulterations.—In addition to the above, *oil of cedar-wood, oil of copaiba,* fixed oils, paraffin, etc., have all been named as having been used to adulterate sandal wood oil. *Triacetin,* a synthetically prepared acetic ester of glycerol, has also been suspected, it has a S.G. 1·175 and is freely soluble in 70 per cent. alcohol. Adulteration in general is best detected by the use of the official tests together with a determination of the percentage of alcohols by the process of acetylation and subsequent saponification. It may be noted that some genuine oils require a temperature of 20° to effect complete solution in 6 vols. of 70 per cent. alcohol.

The *B.P.C.* contains Mistura Olei Santali and a number of compound solutions and mixtures of this oil.

OLEUM CITRONELLÆ.—**Citronelle Oil.**—The volatile oil obtained by distillation from the fresh plant Cymbopogon Nardus, *Rendle* (Andropogon Nardus, *Linn.*)

N.O.—Graminaceæ.

Habitat.—Malacca Peninsula and Ceylon.

Characters, Chemistry, etc.—Of a yellowish-green colour, characteristic odour and pungent taste. S.G. 0·885 to 0·920; soluble in 10 parts of 80 per cent. alcohol. The chief constituent is the aldehyde *citronellal* ($C_{10}H_{18}O$), and in addition, *camphene, dipentene, geraniol,* with a small quantity of *methyl-heptonone* $C_8H_{14}O$ are present. When treated with sodium bisulphite it yields crystals.

Uses, etc.—In perfumery, soap making, etc.

Note.—Two varieties of citronelle are cultivated and distilled for oil, they are distinguished by the growers as "Maha Pangiri" and "Lenubatu Pangiri" the former yields the better oil, being richer in citronellal and in geraniol than the latter which constitutes the bulk of the oil of commerce.

OLEUM VERBENÆ.—Lemon-grass Oil.—The volatile oil obtained by distillation from the cultivated fresh plant of Cymbopogon citratus *Stapf.* and C. flexuosus *Stapf.*

N.O.—Graminaceæ.

Habitat.—India and Ceylon.

Characters, Chemistry, etc.—Of a pale sherry colour, transparent, extremely pungent in taste, and having a peculiar fragrant lemon-like odour. S.G. 0·895 to 0·905. It contains from 75 to 85 per cent. of *citral* ($C_{10}H_{16}O$), together with *methyl-heptonone, geraniol, citronellal, etc.* It yields a crystalline compound when treated with bisulphite of soda.

Note.—True oil of *verbena,* from V. officinalis (*N.O.*—Verbenaceæ), is very similar to lemon-grass oil, but is practically unknown to commerce. *Ionone* (violet perfume) is prepared from the citral of lemon-grass oil by a patented method.

Uses, etc.—In India as stimulant and carminative. *Dose.*—3 to 6 minims; also externally as rubefacient. In this country in perfumery only.

Note.—Oil of Ginger-grass (*Oil of Turkish or Indian Geranium*) is obtained from Cymbopogon martini, *Stapf.* (Andropogon schœnanthus), in India, where it is known as oil of rosé. It contains from 75 to 90 per cent. of *geraniol.* It is imported into Turkey, where it is used for adulterating otto of rose. *Oil of Vitivert* (*Oil of Khus-Khus*) is obtained from the root of Vetiveria zizanioides *Stapf.* (Andropogon muricatus). It has S.G. 1·013, and contains esters, the nature of which is not accurately known. It has a peculiar pungent odour, is very viscous, and is used in perfumery, as also is the root from which it is obtained.

OLEUM JUNIPERI.—Oil of Juniper.—The oil distilled from the full-grown unripe green fruit of Juniperus communis, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 255].

N.O.—Coniferæ.

Habitat.—Europe.

B.P. Characters and Test.—Colourless or pale-greenish yellow, with the characteristic odour of the fruit, and a warm, aromatic, bitterish taste. S.G. 0·865 to 0·890. The oil is soluble, with slight turbidity, in four times its own volume of a mixture of equal parts of absolute alcohol and alcohol (90 per cent.).

Chemistry.—*Pinene* ($C_{10}H_{16}$), *cadinene*, ($C_{15}H_{24}$), *juniper camphor*, with small quantities of esters.

Uses, etc.—As stimulant, carminative and diuretic; a constituent of gin and gin essences. *Dose.*—$\frac{1}{2}$ to 3 minims.

B.P. Preparation.

Spiritus Juniperi - - - - - - 1 in 20.

Contained in Mistura Creosoti.

Note.—The S.G., and probably also the chemical character of this oil, vary both with the degree of maturity of the berries from which it is distilled and with the age of the oil after distillation. The riper the berries, and the longer the time of keeping the oil, the denser does it become. Also English distilled oil from partly-dried berries differs considerably from the genuine foreign oil, being heavier and less soluble than the latter, which is probably distilled from fresh berries. *Juniper wood oil*, as sold, is probably a mixture of the official oil with turpentine, or it is said to be obtained by distilling turpentine over chips of juniper wood.

OLEUM PINI.—Oil of Pine.—The oil distilled from the fresh leaves of Pinus Pumilio, *Haenke* [*Lamb. Gen. Pin.* I. plate 2].

N.O.—Coniferæ.

Habitat.—Europe.

B.P. Characters and Tests.—Colourless, or nearly so, with a pleasant aromatic odour and pungent taste. S.G. 0·865 to 0·870. It should rotate the plane of a ray of polarised light from 5° to 10° to the left at 60° F. (15° C.) in a tube 100 millimetres long. Not more than 10 per cent. should distil below 329° F. (165° C.).

Chemistry.—Contains *lævo-pinene*, *lævo-phellandrene*, *sylvestrene*, *cadinene*, *dipentene* and *bornyl acetate* (5 per cent.).

Uses, etc.—As external rubefacient; for inhalation, etc.

B.P.C. Preparations.—Elixir Pini et Terpini et Acetomorphinæ, Syrupus Pini.

OLEUM PINI SYLVESTRIS.—Fir-Wool Oil.—The oil distilled from the fresh leaves of Pinus sylvestris.

N.O.—Coniferæ.

Habitat.—Europe.

Characters and Tests.—Colourless, or nearly so, with an aromatic lavender-like odour, and a pungent but not unpleasant taste. S.G. not below 0·870. Soluble in about seven times its volume of rectified spirit.

Chemistry, etc.—*Dextro-pinene, sylvestrene, sesquiterpene* and *bornyl acetate.* Good samples should contain not less than five per cent. of the last-named constituent.

Uses, etc.—Externally as rubefacient, also in form of inhalation. Formerly official; now replaced by Oil of Pine (*q.v.*).

Note.—True oil of P. sylvestris is said not to be an article of commerce, various pine-needle oils being sold under the name, amongst them is the oil of Pinus sibirica, possessing a strong balsamic odour, S.G. 0·905 to 0·920, and yielding up to 40 per cent. of esters calculated as bornyl acetate.

OLEUM TEREBINTHINÆ.—Oil of Turpentine.—The oil distilled, usually by the aid of steam, from the oleo-resin (turpentine) obtained from Pinus sylvestris, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iv. plate 257], and other species of Pinus; rectified if necessary.

N.O.—Coniferæ.

Syn.—Spirit of Turpentine.

Habitat.—America, France, etc.

B.P. Characters and Tests.—Limpid, colourless, with a strong peculiar odour, which varies in the different kinds of oil, and a pungent and somewhat bitter taste. It is soluble in its own volume of *glacial acetic acid.* It commences to boil at about 320° F. (160° C.), and almost entirely distils below 356° F. (180° C.), little or no residue remaining.

Method of Production.—During the winter holes capable of holding about a gallon of fluid are excavated close to the foot of the tree, and bark is removed from the tree for a space of several feet above the cavities. The tree is then cut and notched so as to cause a flow of the oleo-resin (*crude turpentine*) which exudes. The product of the whole summer's exudation, run off into barrels as the cavities in the tree fill up, is then distilled with water, and the resulting *oil of turpentine* separated from the water.

Chemistry, etc.—S.G. 0·855 to 0·870. Soluble in three times its volume of alcohol. The rotation of oil of turpentine is very variable. American oil is usually but not invariably dextro-rotary, from 0° to 14°. French oil is lævo-rotary and the angle of rotation may be as high as 40°. The commercial oil commonly contains traces of resin or other oxygenated compounds, but the pure distillate consists of terpenes ($C_{10}H_{16}$)

only, viz., *dextro-pinene* in the case of English or American oil (*australene*), from P. palustris (P. australis), *lævo-pinene* in that of French oil (*terebenthene*), from P. maritima (P. pinaster). Swedish turpentine oil contains pinene and *sylvestrene*, while the Russian product (from P. sylvestris) contains these bodies with *dipentene* in addition. German oil of turpentine from P. sylvestris, P. abies, etc., resembles the American product very nearly.

Note.—The bulk of the oil of turpentine used in this country comes from America (Carolina, etc.), much of it is now produced by the distillation of the sawdust and other waste from the saw mills.

Uses, etc.—As antiseptic, stimulant, diuretic, etc. *Dose.*—2 to 10 minims; to 4 fluid drachms as anthelmintic.

B.P. Preparations.

Linimentum Terebinthinæ - - -	1 in $1\frac{1}{4}$.
Linimentum Terebinthinæ Aceticum -	1 in 2, nearly.

B.P.C. Preparations.—Enema Terebinthinæ, Confectio Terebinthinæ.

Note.—Turpentine Oil Derivatives.—When heated to 250°-300° C. *pinene* (oil of turpentine) is converted into *dipentene* ($C_{10}H_{16}$) and *meta-terebenthene* ($C_{20}H_{32}$). *Artificial Camphor* (pinene hydrochloride, $C_{10}H_{16}$,HCl is obtained by conducting HCl gas into well cooled pinene; it is a crystalline, camphor-like body melting at 125° C. and must not be confused with synthetic camphor (q.v.). By the action of nitric acid in the presence of alcohol and water, turpentine oil is converted into *terpin-hydrate* ($C_{10}H_{20}O_2$, H_2O), an odourless, crystalline substance soluble in hot water. When heated above 100° C. terpin-hydrate loses water and becomes converted into *terpine* $C_{10}H_{18}(OH)_2$, which crystallizes in needles. By treatment with sulphuric acid terpin-hydrate becomes converted into *terpineol*, $C_{10}H_{17}HO$,—a thick, optically inactive liquid. *Camphene* $C_{10}H_{16}$, is a solid terpene obtained by the elimination of the haloid acid from pinene hydrochloride. The preparation known as "*sanitas*" is obtained by blowing air through Russian turpentine oil.

Terebenum P.B. is described by the Pharmacopœia as a mixture of dipentene and other hydrocarbons, obtained by agitating oil of turpentine with successive quantities of sulphuric acid until it no longer rotates the plane of a ray of polarised light, and then distilling in a current of steam. It is a colourless liquid, having an agreeable odour and an aromatic terebinthinate taste. S.G. 0·862 to 0·866. Does not rotate the plane of a ray of polarised light. Should distil between 312·8° and 356° F. (156° and 180° C.), leaving only a slight viscid residue (absence of excess of resin). Not more than 15 per cent. should distil below 329° F. (165° C.).

Note.—The official requirements with regard to terebene are not easily attainable. The boiling point should be somewhat higher and the S.G. lower, about 0·855.

9. FIXED OILS, FATS AND WAXES.—OLEA FIXA, Etc.

Under this head are included a number of substances derived from both plants and animals, possessing certain common physical and chemical characters. The term *fixed oil* or *fatty oil* is applied to such members of the class as are liquid at ordinary temperatures, while such as are solid under similar conditions rank as *fats*. The *waxes* are usually solids, although true liquid waxes occur, and chemically they are somewhat different from the fats and oils.

General Physical Characters of Oils and Fats.—The colour is usually a golden yellow, but oils both lighter (castor oil) and darker (hempseed oil) in colour are not uncommon. Fixed oils and fats do not volatilize without decomposition, not infrequently possess a distinctive odour due to their origin, and are invariably greasy to the touch, producing a permanent translucent stain on paper when brought into contact with it. The S.G. is always less than that of water—varying usually between 0·850 and 0·920. They are insoluble in water, slightly so in alcohol (castor and croton oils are however readily soluble in alcohol) readily soluble in ether, chloroform, benzol, carbon bisulphide, light petroleum and volatile oils. On exposure to the atmosphere for a lengthened period fixed oils decompose to some extent, becoming acid to litmus paper, and acquiring a peculiar and unpleasant odour and taste. This condition is know as *rancidity*, and is partly due to the presence of free fat acids, the formation of which is ascribed to the action of enzymes or ferments in the presence of water. The action of the ferments which produce rancidity is found to be retarded by the addition of certain substances of which benzoin is the most commonly used. In the case of linseed oil and some others there takes place, upon exposure to air, an absorption of oxygen, resulting in the formation of a hard substance, which in thin layers forms a film. Such oils are, on account of this property, known as *drying oils*. In the case of waxes the S.G. is usually somewhat less than of fats and oils, and their relationship to solvents is also somewhat different.

Method of Production of Fixed Oils.—In extracting vegetable oils it is customary to crush the substance and afterwards to subject it to hydraulic pressure, with or without the application of heat. Oils obtained without heat (cold-drawn) are usually more limpid and contain less solid fatty constituents than those procured at higher temperatures. Fixed oils may also be extracted by means of solvents (light petroleum, etc.), and by this method a complete exhaustion of the vegetable tissues results. In dealing with animal oils, heat alone is usually sufficient to remove the oil from the part containing it. Boiling with water is also adopted, and putrefaction of the containing tissues is a factor also made use of for setting free the oil

General Chemical Properties of Fixed Oils and Fats.—All the fixed oils and fats of vegetable and animal origin are *esters* (*ethers*), formed by the combination of certain acids which, owing to their origin, are known as *fatty acids*, with alcohols, of which glycerol is the chief. The majority of them are *triglycerides*, and the acids which most commonly occur are those known as *oleic*, *stearic* and *palmitic* Thus, olive oil consists largely of *triolein*, which is *trioleate of glycerol*. Mixed triglycerides also occur in which (*e.g.* oleo-distearin) one of the hydroxyl groups of glycerol may be replaced by the oleic radicle, the other two by the stearic radicle. Olein (triolein) may be looked upon as the trihydric alcohol glycerol (glycerin), in which three of the hydrogen atoms of the molecule have been replaced with three groups of the oleic radicle, thus:—

$$C_3H_5\begin{cases} OH \\ OH \\ OH \end{cases} \qquad C_3H_5\begin{cases} O.C_{18}H_{33}O \\ O.C_{18}H_{33}O \\ O.C_{18}H_{33}O \end{cases}$$

GLYCEROL. OLEIN.

In the cases of some few fats, probably as the result of decomposition, the molecule may contain only two groups of acid radicle, while amongst the waxes (spermaceti) and certain oils (fluid waxes) with which they are associated (sperm oil) the alcohol radicle is not glycerol, but some member of another series. All the fats are decomposed by boiling alkali with the formation of an alcohol and a salt of the alkali used—the latter being known as a *soap*. Thus, olein when treated with caustic soda yields glycerin (glyceryl alcohol) and soap (sodium oleate). A similar result is obtained when a fat is treated with superheated steam or with a mineral acid, except that, instead of a soap being produced, the fatty acid is set free. The process of treatment of a fat with alkali or other hydrolytic agent is known as *saponification*, and the determination of the amount of alkali required to decompose a given quantity of a fat (*saponification equivalent*) is one of the methods made use of in the analysis of such bodies. Other methods adopted are treatment with bromine and iodine, with which glycerides of unsaturated fatty acids (oleic and others) combine in various proportions, and treatment with sulphuric acid, which causes varying rises of temperature. In addition to these, colour-tests depending upon the hues given with sulphuric and nitric acids, etc., are made use of, as also is treatment with nitrous acid which converts olein into a solid yellow substance known as *elaidin*.

When fats are decomposed by heat they yield vapours of *acrolein*, a strong-smelling volatile compound resulting from the decomposition of glycerin.

Adulteration.—The adulteration of oils, fats and waxes is very common, and in detecting the substances used for this purpose, advantage is taken of the known chemical properties of the oils. The determination of the specific gravity, saponification equivalent, iodine

absorption figure, melting-point of fatty acids, and in a few cases, of the amount of volatile fat acids obtainable, give useful data for ascertaining the presence of adulterants.

OLEUM PAPAVERIS.—Poppy Seed Oil.—The oil expressed from the seeds of Papaver somniferum.

Characters and Tests.—Straw-yellow, limpid, odourless, and having a sweet taste. S.G. 0·924 to 0·927; solidifies at—18° C.; dries rapidly.

Chemistry.—Very similar to linseed oil. Contains glyceryl esters of *linolenic, linolic, oleic* and *palmitic* acids.

Uses, etc.—As demulcent, etc.; in the arts for purposes similar to linseed oil; said to be used for adulterating olive oil.

OLEUM SINAPIS EXPRESSUM.—Expressed Oil of Mustard.—The oil expressed from the seeds of Brassica alba and Brassica nigra.

Characters.—Reddish or brownish-yellow, non-drying, mild-tasting, and not readily becoming rancid, solidifying when cooled to—16° C. S.G. 0·916 to 0·920.

Chemistry.—Consists of glycerides of *oleic, stearic, erucic* (*brassic*) *and arachidic acids.*

Uses, etc.—For purposes similar to olive and rape oils. As diluent of essential oil of mustard in preparing liniments, etc.

Note.—The oil is obtained as a bye-product in the manufacture of "mustard leaves," the rubefacient portion of which consists of the crushed seeds deprived of the fixed oil, but retaining the glucoside and ferment.

OLEUM COLZÆ.—Rape Oil.—The oil expressed from the seeds of Brassica campestris and of other species of Brassica.

N.O.—Cruciferæ.

Habitat.—Europe.

Characters.—Yellowish-brown or brownish-green, viscid, of a peculiar odour and pungent taste; when refined, light in colour and almost tasteless. It has S.G. 0·915 and solidifies at about—6° C.

Chemistry.—Glycerides of *arachidic* and *erucic* acids, etc.

Uses, etc.—As olive oil, etc. Largely as a lubricant and for burning. Used in India as an edible oil.

OLEUM GOSSYPII.—Cotton-seed Oil.—The oil obtained by expression from the seeds of Gossypium herbaceum.

Characters.—In the crude condition the oil is dark-red in colour and has S.G. 0·928 to 0·930. After refining it has S.G. 0·922 to 0·926, is of a straw-yellow colour, or nearly colourless, is free from acridity, has a bland taste, and is almost odourless. It congeals below 0° C., is non-drying, and the combined fat acids melt at 38° C.

Chemistry.—It contains *olein, stearin, palmitin,* and in its crude condition, about 1 per cent. of colouring matter.

Uses, etc.—In place of, and for adulterating, olive oil Has been found mixed as a sophisticant with most fixed oils of greater value. Cotton-seed oil is largely used in the manufacture of soap, and the refined oil is employed in large quantities in the preparation of margarine.

Note.—Cotton-seed stearine, the solid fat deposited in cooling the oil is an article of commerce and is used as a lard or butter substitute.

OLEUM THEOBROMATIS.—Oil of Theobroma.—A concrete oil obtained by pressing the warm crushed seeds of Theobroma Cacao.

Syn.—Butyrum Cacao, Cacao butter.

B.P. Characters and Tests.—A yellowish-white solid, breaking with smooth fracture; odour resembling that of cocoa; taste bland and agreeable; free from rancidity. It softens at 80° F. (26·6 C.) and melts at temperatures between 88° and 93° F. (31·1° and 33·9 C.). If 1 gramme be dissolved in 3 cubic centimetres of *ether*, in a test-tube, at 62° or 63° F. (or 17° C.), and the tube be placed in water at 32° F. (0° C.), the liquid should neither become turbid nor deposit a granular mass in less than three minutes; and if the mixture after congealing be exposed to a temperature of 60° F. (15·5° C.), it should gradually afford a clear solution (absence of other fats).

Method of Production.—The process usually adopted for obtaining oil of theobroma from the seeds is that of expression of the roasted seeds between hot iron plates or rollers. It may also be obtained by decoction and by the action of solvents.

Chemistry, etc.—S.G. at 15° C. 0·970 to 0·980; soluble in ether, acetic ether, and in 20 parts of hot alcohol. Consists of the glycerides of *stearic*, *oleic*, and, in less proportion, *lauric*, *linolic*, *palmitic* and *arachidic acids*. It is also said to contain a peculiar substance, *theobromic acid*, $C_{64}H_{128}O_2$, probably, however, this is arachidic acid.

Uses etc.—As base for suppositories, pessaries, etc., and in the preparation of ointments, plasters.

B.P. Preparations.

Suppositoria Acid. Carbolic.
„ Acidi Tannici.
„ Belladonnæ.
„ Iodoformi.
„ Morphinæ.
„ Plumbi Composita.

Note.—The advantages possessed by Cacao Butter as an ingredient of suppositories are due to its melting point—the temperature of this being somewhat lower than that of the blood and to its comparative hardness at temperatures not far removed from the melting point.

OLEUM LINI.—Linseed Oil.—The oil expressed from Linseed at ordinary temperatures.

B.P. Characters.—Viscid, yellow with a faint but distinct odour and bland taste. S.G. 0·930 to 0·940. It is soluble in 10 parts of alcohol (90 per cent.), and in Oil of Turpentine. It gradually thickens by exposure to the air, forming, when spread in a thin layer on glass, a hard transparent varnish. It does not congeal above —20° C.

Chemistry, etc.—Glycerides of *oleic*, *linolic*, *linolenic*, *isolinolenic*, *palmitic* and *myristic* acids.

Uses, etc.—Medicinally used as a laxative; in the arts linseed oil is largely employed as a vehicle for paint, etc., on account of its pronounced drying properties.

Note.—The official statement regarding the solubility of the oil in alcohol is incorrect. Linseed oil is liable to adulteration with mineral or non-drying vegetable oils, also with various fish oils; the detection of the former is easily accomplished by determining unsaponifiable matter, iodine absorption, etc., and also by the simple drying test of the B.P. The detection of admixed fish oils is a much more difficult matter. *Boiled Oil* is produced by heating "raw" linseed oil to a temperature of about 150° C., together with a small proportion of a metallic "drier," usully a lead or manganese salt. It possesses the drying properties of linseed oil in an enhanced degree.

OLEUM AMYGDALÆ.—Almond Oil.—The oil expressed from the Bitter or Sweet Almond.

B.P. Characters and Tests.—Pale yellow, nearly inodorous, with a bland nutty taste. Soluble in *ether* and *chloroform* in all proportions. S.G. 0·915 to 0·920. It does not congeal until cooled to nearly —4° F. (—20° C.). If 2 cubic centimetres of the oil be well shaken with 1 cubic centimetre of *fuming nitric acid* and 1 cubic centimetre of *water*, a whitish, not brownish-red, mixture should be formed, which after standing for 6 hours at about 50° F. (10° C.) should separate into a solid white mass and a nearly colourless liquid (absence of peach-kernel oil and other fixed oils).

Chemistry, etc.—Consists mainly of *olein*, together with glycerides of other fatty acids including *linolic*. Stearin has been proved absent. Almond oil is liable to adulteration with apricot kernel oil, an admixture which may be detected by the official colour test, and if the amount is large by the increased iodine absorption figure, which should not exceed 105 per cent. for the genuine oil. Almond oil is also characterised by the low melting point of its fatty acids which should remain liquid at 15° C.

B.P. Preparations.
See Amygdala.

Uses.—Externally, emollient; internally, demulcent and laxative. *Dose.*—1 to 4 fluid drachms.

OLEUM OLIVÆ.—Olive Oil.—The oil expressed from the ripe fruit of Olea europæa, *Linn.* [*Bentl. and Trim. Med. Pl.* vol. iii. plate 172].

N.O.—Oleaceæ.

Habitat.—South Europe and Asia; cultivated in California and South Australia.

B.P. Characters and Tests.—Pale yellow or greenish-yellow, with a faint odour, and a bland taste. S.G. 0·914 to 0·919.

At 50° F. (10° C.) it is liable to become of a pasty consistence, and at 32° F. (0° C.) to form a nearly solid granular mass. If 10 cubic centimetres of the oil be shaken with 2 cubic centimetres of a reagent prepared by dissolving 1 gramme of *silver nitrate* in 100 cubic centimetres of *absolute alcohol*, with the addition of 20 cubic centimetres of *ether* and one drop of *nitric acid*, no blackening should occur when the mixture is heated on a water-bath for ten minutes (absence of cotton-seed oil).

Note.—The B.P. test for cotton-seed oil does not give uniformly satisfactory results; with some oils of undoubted purity a darkening if not blackening occurs when the official test is applied. Reliance should not therefore be placed on this test alone; the Halphen colour reaction is more reliable and the elaidin production, iodine absorption, etc., should also be used. (*See* below).

Mode of Production.—The purest oil, *virgin oil*, is that obtained by moderate pressure of the fruit. A second quality is got from a further pressure of the "cake," either with or without previous treatment with hot water. The last portions of oil may be removed by treatment of the mass with solvents, *e.g.*, carbon bisulphide. An inferior quality is obtained by pressing fruit which has been previously allowed to ferment. The finest oils are imported from Leghorn, and those from Provence and Tuscany are highly esteemed. That sold in "Florence flasks" has no longer the high reputation which it once enjoyed. The olives of the shops are the unripe fruits collected when green and preserved in salt and water after being first soaked in a weak alkaline solution. When ripe they are purple and if pressed without breaking the kernels, immediately after they are gathered, a very pure oil is obtained, of a greenish tint, which does not become rancid, this being the *virgin* oil of commerce. The amount of free fatty acid present in olive oil varies from 0·4 per cent. in virgin oil to as much as 30 per cent. or more in the oils obtained by fermentation.

Chemistry.—At 10° C. it becomes semi-solid, *tripalmitin* crystallizing out in a granular form; the remaining fluid portion consists mainly of *triolein*. In addition to these bodies there are present traces of *arachidic* esters, and there is usually a small percentage of free *oleic acid*; stearic acid is absent.

Uses, etc.—As nutritive and demulcent; has slight laxative action. *Dose.*—½ to 1 fluid ounce.

B.P. Preparations.

Emplastrum Ammoniaci cum Hydrargyro.
,, Hydrargyri.
,, Picis.
,, Plumbi.
Linimentum Ammoniæ.
,, Calcis.
,, Camphoræ.
Sapo Durus.
,, Mollis.
Unguentum Cantharidis.
,, Hydrargyri Compositum.
,, ,, Nitratis.

Note.—The ammonia and lime liniments of the Pharmacopœia are emulsions formed by the soap produced by the partial saponification of the oil in each case.

Adulteration of Olive Oil.—This is extensively practised. Cotton-seed, poppy-seed, sesame and rape oils are amongst the adulterants made use of. The U.S.P. gives the following tests for the purity of olive oil:—

Very sparingly soluble in alcohol, but readily soluble in ether, chloroform, or carbon disulphide.

When cooled to from 8° to 10° C. (46·4° to 50° F.), the Oil becomes somewhat cloudy from the separation of crystalline particles, and at 0° C. (32° F.), it forms a whitish, granular mass.

If 2 cubic centimetres of Olive Oil be shaken vigorously with an equal volume of nitric acid (S.G. 1·37), the Oil should retain a light-yellow colour, not becoming orange or reddish-brown, and after standing for six hours should change into a yellowish-white solid mass and an almost colourless liquid (absence of appreciable quantities of *cotton-seed oil* and *most other seed oils*).

If 5 cubic centimetres of the Oil be thoroughly shaken in a test-tube with 5 cubic centimetres of an alcoholic solution of silver nitrate (made by dissolving 0·1 Gm. of silver nitrate in 10 cubic centimetres of alcohol and adding 2 drops of nitric acid), and the mixture be heated for about five minutes in a water-bath, the Oil should retain its original pale colour, not becoming reddish or brown, nor should any dark colour be produced at the line of contact of the two liquids (absence of more than about 5 per cent. of *cotton-seed oil*).

If 2 cubic centimetres of the Oil be mixed in a test-tube with 2 cubic centimetres of equal volumes of amyl alcohol and carbon disulphide containing 1 per cent. of sulphur in solution, and the test-tube be immersed to one-third or one-half its depth in boiling salt water, no reddish colour should develop in from ten to fifteen minutes (absence of *cotton-seed oil*). [This is the test known as the Halphen test, and forms one of the most valuable reactions for the detection of cotton-seed oil].

If 2 cubic centimetres of the Oil be mixed with 1 cubic centimetre of hydrochloric acid (S.G. 1·18) containing 1 per cent. of sugar, and the mixture be shaken for half a minute and allowed to stand for five minutes, and then 3 cubic centimetres of water added and the whole again shaken, the acid layer should not show a pink colour (absence of *sesame oil*).

Olive Oil, saponified by alcoholic potassium hydroxide should show a saponification value of 191 to 195.

If 0·3 Gm. of Olive Oil be dissolved in 10 cubic centimetres of chloroform, in a 250 cubic centimetre bottle or flask, and 25 cubic centimetres of a mixture of equal volumes of alcoholic iodine and alcoholic mercuric chloride added, and if, after standing for four hours, protected from light, 20 cubic centimetres of solution of potassium iodide be introduced, and the mixture diluted with 50 cubic centimetres of water, on titrating the excess of iodine with tenth-normal sodium thiosulphate, an iodine value of not less than 80 nor more than 88 should be obtained.

Oleic Acid, Acid. Oleicum, P.B., $C_{17}H_{33}COOH$, is described as a fluid fatty acid obtained by the saponification of olein or by the action of superheated steam on fats, with subsequent separation from solid fats by pressure. Usually not quite pure. It is a straw-coloured liquid, nearly odourless and tasteless, and with not more than a very faint acid reaction; unduly exposed to air it becomes brown and decidedly acid. S.G. 0·890 to 0·910. It is used in preparing Hydrargyri Oleas P.B., various official ointments, and in the Oleinata of the B.P. Codex.

OLEUM CROTONIS.—Croton Oil.—The oil expressed from the seeds of Croton Tiglium.

Syn.—Oleum Tiglii.

B.P. Characters and Tests.—Brownish-yellow to dark reddish-brown, viscid, with a disagreeable odour and an acrid burning taste. S.G. 0·940 to 0·960. Entirely soluble in absolute alcohol. Freely soluble in ether and chloroform. An alcoholic solution should not redden moistened blue litmus paper. If to 2 cubic centimetres 1 cubic centimetre of fuming nitric acid and 1 of water be added, and the mixture be shaken vigorously, it should not solidify, either completely or partially, but only thicken slightly, after standing for two days (absence of other non-drying oils).

Note.—A freshly-expressed oil is soluble in 60 parts of alcohol, and the solubility increases by age through the increase in the amount of free acid present.

Chemistry, etc.—The oil contains the glyceryl esters of *stearic*, *palmitic*, *myristic*, *lauric* and *oleic acids*, and of also *formic*, *acetic*, *isobutyric* and *isovaleric acids*. There are also present *tiglic acid*, $C_5H_8O_2$ (isomeric with angelic acid), and the so-called *crotonoleic acid*, which is soluble in alcohol, has a vesicating action, and has been shown to be a mixture of inactive fat acids with a resinous substance *croton-resin* ($C_{13}H_{18}O_4$), the chemical nature of which is not yet understood, and to which the vesicant action of the oil is due. The purgative action is variously stated to be due to the last-named acid, and to belong to other constituents.

Uses, etc.—Internally one of the most powerful purgatives known. *Dose.*—$\frac{1}{2}$ to 1 minim. Externally as stimulant and counter-irritant.

B.P. Preparation.

Linimentum Crotonis, 1 in 8 of alcohol (90 per cent.) with Oil of Cajuput.

OLEUM RICINI.—Castor Oil.—The Oil expressed from the seeds of Ricinus communis, *Linn.*

Syn.—Oleum Palmæ Christi.

B.P. Characters and Tests.—Viscid, colourless or with a faint tinge of yellow, having scarcely any odour, and a taste bland at first, but subsequently acrid and unpleasant. S.G. 0·950 to 0·970. Soluble in an equal volume of absolute alcohol, and in five times its volume of alcohol (90 per cent.). It dries slowly to a varnish when exposed to the air in a thin layer. If three cubic centimetres of the oil be shaken with an equal volume of carbon bisulphide, and one cubic centimetre of sulphuric acid be then added, the mixture on being shaken should not become brown (absence of various fixed oils, including cotton-seed oil).* Equal volumes of castor oil and petroleum spirit do

not yield a clear mixture if kept at 60° F. (15·5 C.); but they yield a perfectly clear solution if other fixed oils be present.

*This test cannot be regarded as satisfactory since the purest oils will give a brown colour when treated with sulphuric acid. The substitution of the U.S.P. expression "blackish-brown" for "brown" of the B.P. is advisable.

Mode of Preparation.

(a). *Italian.*—Obtained by removing the seed-integuments, crushing and subjecting to powerful hydraulic pressure in rooms heated in winter to about 20° C. The removal of the oil from the seed is facilitated by placing plates, warmed to from 32° to 38° C., between the press bags.

(b). *East Indian.*—The seeds are boiled with water and the oil skimmed off and strained through flannel into tins. They are also subjected to pressure by hydraulic machines, and the oil is afterwards purified in a very imperfect way by heating with water.

(c). *American.*—Obtained by expression with heat, the oil is allowed to settle, and finally decanted.

Of these three varieties the Italian is the best—the East Indian the poorest. The former owes its freedom from acridity and unpleasant taste partly to the removal of the seed-coats before pressing, and partly to the low temperature used during the manufacture.

Chemistry, etc.—It is insoluble in petroleum spirit, thus, as well as by its high density and solubility in alcohol, differing from the majority of fixed oils. It consists of *triricinolein*, $C_3H_5(C_{18}H_{34}O_3)_3$, and solid fat which is a mixture of *tristearin* and the glyceride of *dihydroxystearic acid*. By treatment with nitric acid, ricinolein yields a crystalline substance *ricinelaidin*. When distilled in a partial vacuum castor oil yields œnanthol. In addition to the above-named constituents it is said to contain an acrid substance (*see Ricini Semina*), regarded by some as the active principle; it seems probable, however, that the purgative action is due to the ricinolein which it contains. Castor oil is dextro-rotary, a property peculiar amongst fixed oils.

Adulterations are easily detected by the alterations they produce in the S.G., solubilities and other characters, castor oil differing markedly in many ways from other fixed oils.

Uses, etc.—As demulcent and purgative. *Dose.*—1 to 8 fluid drachms.

B.P. Preparations.

Collodium Flexile - - - 1 in 50, about.
Linimentum Sinapis Compositum, 1 fl. drachm to 1 fl. oz.
Mistura Olei Ricini - - - 3 in 8.
Pilula Hydrargyri Subchloridi Composita.

B.P.C. Preparations.—Oleum Ricini Aromaticum, Enema Olei Ricini, Enema Olei Ricini c. Sapone.

Note.—Castor Oil Powder is usually a combination of magnesia with ricinoleic acid.

OLEUM CANNABIS.—Hemp-seed Oil.—The oil expressed from the fruit of Cannabis sativa.

Characters and Tests.—Greenish-yellow, becoming brown on keeping; odour hemp-like, unpleasant; taste bland; S.G. 0·925 to 0·931. Dries rapidly on exposure.

Chemistry, Uses, etc.—Similar to linseed oil.

OLEUM JUGLANDIS.—Oil of Walnut.—The oil expressed from the ripe kernels of Juglans regia, *Linn.*

N.O.—Juglandaceæ.

Habitat.—Central Asia; cultivated.

Characters, etc.—Golden straw-yellow in colour, almost without odour, and having a pleasant nutty taste. S.G. 0·925. Solidifies at —15° C. Dries rapidly.

Chemistry.—Similar to linseed oil.

Uses, etc.—For purposes similar to those for which other bland fixed oils are used; also in the arts as a valuable drying oil.

OLEUM COCOIS.—Cocoa-Nut Oil.—The oil obtained either by expression or by decoction from the fruit of the Cocoa-nut Palm, Cocos nucifera, *Linn.*, and C. butyracea, *Linn.*

N.O.—Palmaceæ.

Syn.—Oleum Cocos, Coprah oil.

Habitat.—All tropical countries.

Characters.—Fine white colour, of the consistence of lard at ordinary temperatures, becoming solid like suet between 4·4° and 10° C., and liquid at about 26·6° C.; taste bland and peculiar; odour peculiar not disagreeable. Soluble in alcohol.

Chemistry.—Cocoa-nut oil contains the glycerides of *lauric, myristic, stearic, oleic* and *palmitic* acids, with the volatile fatty *capric, caprylic* and *caproic* acids.

Uses, etc.—Internally as demulcent and nutrient; externally as substitute for lard. Cocoa-nut oil soap, not being precipitated by sodium chloride, is useful for sea water washing.

Note.—Cocoa-nut stearine obtained by subjecting the oil to hydraulic pressure, has melting point about 28° C., and is recommended by Squire as a basis for suppositories preferable to Theobroma oil. This substance has also been used after purification as a butter-adulterant, the high proportion of volatile fatty acids yielded masking its use when the butter is examined according to the Reichert process.

OLEUM PALMÆ.—A fixed oil obtained by expression from the fruit of Elais guineensis, *Jacq.*, and other species.

N.O.—Palmaceæ.

Habitat.—Africa, West Indies and South America.

Characters.—Of the consistence of butter; it has a rich orange-yellow colour, sweetish taste and an agreeable odour, compared by some to that of violets, by others to that of the Florentine orris. Becomes rancid very readily and of a paler colour by age. It is soluble in absolute alcohol and in ether. S.G. 0·920 to 0·926; melting-point, 27° C.

Chemistry.—Glycerides of *palmitic* and *oleic acids*, with a yellow colouring matter (*lipochrome*). It usually contains a considerable portion of free fatty acids, the percentage varying from 11 to 70.

Uses, etc.—For ointments; also in soap and candle making and as a lubricant.

Adulterations.—Palm oil is seldom adulterated with other fats but may contain considerable quantities of water, earth, etc.

Note.—Palm oil proper is from the outer coating of the seed, a product (*Palm-nut oil*) of lighter colour and in most respects resembling cocoa-nut oil being found in the kernels. Commercial palm oil is a very variable product, samples differing in colour, in consistency and in purity. The Calabar oil is one of the best kinds.

FATS, OILS AND WAXES OF ANIMAL ORIGIN.

ADEPS.—Lard.—The purified fat of the hog, Sus scrofa, *Linn.*

CLASS—MAMMALIA.

N.O.—Pachydermata.

Syn.—Axungia, Adeps Porci.

From the perfectly fresh fat of the abdomen of the hog remove as much of the external membranes as possible; suspend the fat so that it shall be freely exposed to the air for some hours; cut it into small pieces; reduce these to a uniform mass in which the membranous vesicles are completely broken, by beating in a mortar or by some similar process; put the mass thus produced into a vessel surrounded by warm water; heat to a temperature not exceeding 125° F. (57·2° C.) until the fat has melted and separated from the membranous matter; strain.

B.P. Characters and Tests.—A soft, white, fatty substance, fusing at about 100° F. (37·8° C.), and forming a clear liquid at a somewhat higher temperature. Has no rancid odour; is neutral to *litmus*; dissolves entirely in *ether*. It should yield no reaction with the tests for sodium, chlorides, or starch. If a solution of 0·05 gramme of *silver nitrate* in 5 cubic centimetres of *alcohol* (90 per cent.), to which a drop of *nitric acid* has been added, be heated with 5 cubic centimetres of melted lard on a water-bath for 5 minutes and then vigorously shaken, the fatty layer which separates on standing should not darken in colour (absence of cotton-seed oil). 10 grammes of lard dissolved in a mixture of equal volumes of *chloroform* and *alcohol* (90 per cent.), two drops of *solution of phenol-phthalein* being added, should not require more than 0·2 cubic centimetre of the *volumetric solution of sodium hydroxide* to produce a permanent red colour (limit of acidity).

Chemistry, etc.—S.G. about 0·932 at 15° C., or 0·860 to 0·861 at 98° to 99° C. Consists of a mixture of *olein* (about 50 per cent.), *palmitin*, *stearin*, *laurin*, *myristin* with a little *linolin*. The melting-point varies somewhat with the part of the animal used for obtaining the fat, that of the omentum (*adeps omenti*) being higher.

Adulterations.—Amongst the substances used for this purpose are—water, which may be detected by heating the lard on a water-bath to a constant weight; cocoa-nut oil, which causes an increase in density; cotton-seed oil or cotton-seed stearin; and starch, for the detection of which, and of salt, the B.P. gives tests. Mineral additions may be

detected by igniting the lard, which should leave no residue. Beef fat and beef stearine also are largely employed as adulterants.

Note.—Much of the lard of commerce is prepared from fat derived from other parts of the pig than the abdomen.

Uses, etc.—As emollient, demulcent, etc.; in the preparation of ointments.

B.P. Preparations.

Adeps Benzoatus.
Emplastrum Cantharidis.
Pilula Phosphori.
Unguenta, *various*.

Note.—*Lard oil* (Oleum adipis, U.S.P.) is a fixed oil expressed from lard at a low temperature. It is a colourless or pale-yellow oily liquid, having a peculiar odour and a bland taste. S.G. 0·910 to 0·915 at 15° C. It consists chiefly of olein with varying proportions of palmitin and stearin. It is used largely as a lubricant as well as in pharmacy. *Adeps Induratus* is lard from which some of the oil has been removed by pressure, it is official in the B.P. for use in Colonies, etc., where prevailing temperatures are such as to render ordinary lard too soft for use.

OLEUM BUBULUM.—Neats' Foot Oil.—The oil obtained from the feet of various cattle by the action of boiling water with subsequent separation.

Syn.—Oleum pedum tauri, oleum nervinum.

Characters and Tests.—Yellowish, odourless, with a bland taste; not liable to become rancid; S.G. about 0·916; solidifies below 0° C. Combined fat acids melt at 30° C.

Chemistry.—Consists of *olein*, *palmitin*, *stearin*, etc.

Uses, etc.—Externally in pomades, etc. On account of its low solidifying point useful in lubricating machinery worked at a low temperature.

Note.—Much neats' foot oil on the market is not genuine. The true oil is distinguished by its low iodine figure of 69 to 71.

SEVUM PRÆPARATUM—Prepared Suet.

The internal fat of the abdomen of the sheep, Ovis Aries, *Linn.*, purified by melting and straining.

CLASS—MAMMALIA.

N.O.—Ungulata.

Syn.—Mutton suet.

B.P. Characters and Tests.—White, smooth, almost odourless; melting point between 112° and 120° F. (44·4° and 48·9° C.); commences to re-solidify at about 100° F. (37·8 C.). Freely soluble in *petroleum spirit*, slowly soluble in *benzol*, insoluble in cold *alcohol* (90 per cent.), slightly soluble in *ether* or boiling *alcohol* (90 per cent.).

Chemistry.—*Stearin* and *palmitin* (70 per cent.), *olein* (30 per cent.), with a trace of free fat acids.

Uses, etc.—In ointments, plasters, etc.

B.P. Preparations.

Unguentum Hydrargyri.

Note.—*Beef suet* has a very similar composition to the above, but melts at a slightly lower temperature.

ADEPS LANÆ.—Wool Fat.—The purified cholesterin-fat of the wool of the sheep, Ovis Aries.

CLASS—MAMMALIA.

N.O.—Ungulata.

B.P. Characters and Tests.—A yellowish, tenacious, unctuous substance; almost inodorous; with a melting point varying from 104° to 112° F. (40° to 44·4°C.); readily soluble in ether or in chloroform, sparingly soluble in rectified spirit. 1 gramme should dissolve almost completely in 75 cubic centimetres of boiling alcohol (90 per cent.), the greater part separating in flocks on cooling. Ignited with free access of air, it leaves but a trace of ash (0·3 per cent.) which should not be alkaline to litmus. 10 grammes dissolved in 25 cubic centimetres of ether, two drops of solution of phenol-phthalein being added, should not require more than 0·1 cubic centimetre of volumetric solution of sodium hydroxide to produce a permanent red colouration (*limit of acidity*). The solution, in chloroform, poured gently over the surface of sulphuric acid acquires a purplish-red colour. Heated with a solution of sodium hydroxide, no ammoniacal odour should be evolved (absence of nitrogenous animal matter).

Method of Production.—Wool-fat may be obtained from sheep's wool by the action of solvents, such as ether, light petroleum, alcohol, etc., or by the process patented by Liebreich, which consists essentially in treating the wool with alkali (which saponifies part of the fat), removing the dirt by centrifugal machinery, precipitating the fat from the alkaline mixture by the addition of acid, and kneading with water. The wool-fat thus obtained contains much water, and is rendered anhydrous by the aid of heat which, when applied, causes the fat to separate, when it is skimmed off from the surface of the separated water.

Chemistry.—Palmitic and stearic esters of *cholesterol* $C_{26}H_{43}(OH)$, and *iso-cholesterol*, with smaller quantities of glycerides of both the higher and lower fatty acids. Cholesterol is regarded as being a monovalent alcohol, and occurs in various parts of the animal organism, having been first discovered in gall-stones. It unites with fat acids, forming esters similar to the glycerides, is soluble in alcohol and in ether, insoluble in water, and, of course, cannot be saponified.

Uses, etc.—As basis for ointments, etc. Valued on account of its reputed ready absorption by the skin and absence of tendency to rancidity; also on account of the large proportion of water which it will take up. It is commonly known by the name of "anhydrous lanoline."

B.P. Preparation.

Adeps Lanæ Hydrosus.

Used in Unguentum Conii and Unguentum Hamamelidis.

ADEPS LANÆ HYDROSUS.—HYDROUS WOOL-FAT.—Consists of a mixture of 70 parts of wool-fat with 30 parts of water. It is commonly known by the name of "lanoline."

CERA FLAVA.—Yellow Beeswax.—Prepared from the honeycomb of the Hive Bee, Apis mellifica, *Linn.* [*Brandt and Ratzeburg, Med. Zool.* vol. ii. tab. xxiv.].

CLASS—INSECTA.

N.O.—Hymenoptera.

Habitat.—England, Europe, etc.

B.P. Characters and Tests—Firm, breaking with a granular fracture, yellowish, having an agreeable honey-like odour. Not unctuous to the touch. It should be readily and entirely soluble in hot *oil of turpentine*. It should not yield more than 3 per cent. to cold *alcohol* (90 per cent.), nor more than 50 per cent. to cold *ether*, and nothing to *water* or to boiling *solution of sodium hydroxide*, the two latter liquids after filtration neither being turbid nor yielding a precipitate on the addition of *hydrochloric acid* (absence of fatty acids, resin, and Japan wax). S.G. 0·960 to 0·970. Melts at 144·5° to 147° F. (62·5° to 63·9° C.) when tested in the following manner. Liquefy a small piece, and draw a little of the liquid Beeswax up into a capillary tube of not more than one millimetre in internal diameter; after it has been allowed to cool for three hours, fix a piece of the filled capillary tube to the bulb of a thermometer by thread; immerse the bulb and tube in a beaker of water, and heat the latter gradually on a water bath; at the moment the opaque rod of Beeswax becomes transparent, note the temperature. The solidifying point is two to three degrees lower than the melting point. 5 grammes of the Beeswax, melted in and mixed with boiling *alcohol* (90 per cent.), should require for neutralisation not less than 1·6 cubic centimetres of *normal alcoholic volumetric solution of potassium hydroxide*, using *phenol-phthalein* as an indicator. Upon the further addition of 20 cubic centimetres of the volumetric solution, and well boiling for one hour under a reflux condenser, not less than 6·2 nor more than 6·8 cubic centimetres should be found to have combined with the Beeswax, as shown by the titration of the uncombined alkali with *volumetric solution of sulphuric acid*. If 5 grammes of Beeswax are heated for fifteen minutes with 25 grammes of *sulphuric acid* to 320° F. (160° C.) and the mixture diluted with *water*, no solid waxlike body should separate (absence of paraffin). Beeswax should not yield any characteristic reaction with the tests for starch.

Method of Production, etc.—After the removal of the honey the comb is subjected to pressure and treated with hot water. The wax rises to the surface, is allowed to cool and, when solid, is removed. Amongst the varieties met with in commerce the following may be mentioned:—*English, French, Italian, African* (*Madagascar, Gambia*), *Australian, Chilian, Mogador, Mauritius, East India* and *Jamaica*. Of these, the kind most valued in this country is English wax. The tropical waxes frequently contain much dirt and similar impurities.

Chemistry.—*Cerolein* (aromatic and colouring matter), 3 to 5 per cent.; *cerotic acid* (*cerin*), $C_{26}H_{53}COOH$, about 10 to 20 per cent.; *myricin* (*myricyl palmitate*), $C_{30}H_{61}.C_{16}H_{31}O_2$, about 80 to 90 per cent. Cerolein is soluble in cold alcohol; cerotic acid in boiling alcohol; myricin is insoluble in alcohol. Cerotic acid, which exists in the free state, may be removed by hot alcohol, and is a granular substance, melting at 79° C.; myricin is a solid wax-like body, melting at 64° C., soluble in benzol, ether and oil of turpentine.

Adulterations.—Beeswax is not infrequently adulterated. Tests for the detection of several of the substances used are given above, under "Characters and Tests." The melting point and S.G. are of great value in testing samples. *Carnaüba* wax may be detected from the increased density and higher melting point, which its admixture with beeswax would produce. *Paraffin*, *cerasin* and *ozokerite* resist the action of hot concentrated sulphuric acid, hence the sulphuric acid test of the B.P.

Uses, etc.—In the making of plasters, ointments, etc.

B.P. Preparations.

Cera Alba.
Emplastrum Calefaciens.
,, Cantharidis.
,, Menthol.
,, Picis.
Unguentum Hydrargyri Compositum.
,, Picis Liquidæ.
,, Resinæ.
,, Staphisagriæ.

CERA ALBA.—White Beeswax.—Yellow Beeswax which has been bleached by exposure to moisture, air, and light.

CLASS—INSECTA.

N.O.—Hymenoptera.

Syn.—Cera dealbata.

Habitat.—England, Europe, etc.

B.P. Characters and Tests.—Hard, nearly white, translucent masses. It should respond to the tests for Yellow Beeswax.

Note.—Beeswax is bleached by repeated melting in water and exposure to sunlight, also by treatment with animal charcoal, or chemically with potassium permanganate and sulphuric acid, etc. Its constitution undergoes some changes in the bleaching process; the melting point is more variable, and the S.G. is usually somewhat higher.

Uses, etc.—In ointments, etc.

B.P. Preparations.

Pilula Phosphori.
Suppositoria Acidi Carbolici.
Unguentum Aquæ Rosæ.
,, Cetacei.

Note.—White Wax of Commerce.—This is frequently met with in elegant white cakes, consisting of a mixture of purified beeswax with other substances, such as paraffin, spermaceti, Japan wax, etc. For making cold cream, for laundry use, and for other purposes, this mixture, on account of its whiter colour, is sometimes preferred to the pure substance.

Japan Wax is obtained in Japan by expression and heat, or by the action of solvents, from the fruit of RHUS SUCCEDANEA and other species. It has S.G. 0·970 to 0·980, and melts at 50° to 53° C. It consists almost entirely of *palmitin* and free *palmitic acid*, and is not a true *wax*, it obtains use in candle-making, for adulterating white beeswax, and in making pomades.

Myrtle Wax is obtained in the U.S. by boiling the fruit of MYRICA CERIFERA (the wax-myrtle) and other species with water. It has a green colour, is hard, and has a feeble taste and smell. It has S.G. about 1·000, and melts at 45° to 46° C. It consists mainly of the glycerides of *palmitic acid*, and therefore also is not a true wax.

Chinese Wax, Insect Wax, is the secretion of an insect (COCCUS CERIFERUS) which lives on the *Chinese Privet* (LIGUSTRUM LUCIDUM) and other trees. In appearance it much resembles spermaceti, but is harder and more readily powdered. It has S.G. 0·970, melts at 83° C., and consists of *ceryl cerotate* ($C_{26}H_{53},C_{26}H_{51}O_2$). It is used in the arts for candle-making, etc.

Carnaüba, Canauba, Carnahuba Wax is obtained from the leaves of COPERNICA (CORYPHA) CERIFERA. It is a hard, greenish-yellow, usually tasteless and odourless wax, of S.G. about 1·000, melting at 80° to 85° C. Its constitution is highly complex, there being present amongst other bodies, *myricyl alcohol* and *cerotic acid* (both free and intercombined). When boiled with caustic potash it assumes a reddish colour, and is only partially saponifiable. It is used in candle-making and as an adulterant of beeswax (*which see*), also to an increasing extent as an ingredient in boot-polish.

CETACEUM.—**Spermaceti.**—A concrete fatty substance, obtained, mixed with oil, from the head of the Sperm Whale, Physeter macrocephalus, *Linn.* [*Brandt and Ratzeburg, Med. Zool.* vol. ii. tab. ix. fig. 3]. It is separated from the oil by filtration and pressure, and is afterwards purified.

CLASS—MAMMALIA.

N.O.—Cetacea.

Habitat.—Pacific and Indian Oceans.

B.P. Characters and Tests.—In crystalline, pearly-white, glistening masses, which are translucent, slightly unctuous to the touch, and have little taste or odour. It is reducible to powder by the aid of a little *alcohol* (90 per cent.). It is insoluble in *water*, and nearly insoluble in cold *alcohol* (90 per cent.), but soluble in *ether*, *chloroform*, boiling *alcohol* (90 per cent.), and in fixed and volatile oils. Melting point 114·8° to 122° F. (46° to 50° C.) when tested by the method described under 'Cera Flava.' 0·2 gramme dissolved, by the aid of a water-bath, in 20 cubic centimetres of *alcohol* (90 per cent.), two drops of *solution of phenol-phthalein* being added, should not require more than one drop of *volumetric solution of sodium hydroxide* to produce a permanent red colour (limit of acidity). Boiled with *alcohol* (90 per cent.), and the mixture cooled and filtered, the filtrate should not afford a flocculent precipitate on the addition of *water* (absence of stearic acid).

Method of Production, etc.—As the specific name of this mammal indicates, it has a large head, the superior portion of which consists of large cartilaginous cavities filled with oily matter (sperm oil and spermaceti). A hole is made into this space, when the liquid contents exude and are collected. This is known as head matter, and is placed in hair bags and

subjected to hydraulic pressure, which separates nearly all the oil. The spermaceti is then re-melted in water, the impurities being skimmed off. Subsequently it is again melted in a weak solution of potash, and finally allowed to assume large crystalline masses. The oil from the blubber also contains spermaceti, and is used for obtaining it.

Chemistry.—S.G. 0·942 to 0·946 at 15·5° C., or 0·808 to 0·812 at 100° C. Consists almost entirely of *cetin, cetyl palmitate*, $C_{16}H_{38}O.C_{16}H_{31}O$, which, on saponification, yields palmitic acid and *cetyl alcohol (ethal)*; small quantities of lauric, myristic and stearic acids, combined with alcohols of the same series as ethal, are also present.

Adulterations.—For this purpose stearin, tallow and paraffin wax are said to be used. The two former may be detected by noting the large percentage of caustic potash (KHO) required to saponify the sample (spermaceti when pure requires 12·8 per cent.); paraffin on the other hand is non-saponifiable and cannot be destroyed by strong sulphuric acid.

Uses, etc.—Internally as demulcent, emollient, etc., externally in ointments, etc.

B.P. Preparations.

Unguentum Aquæ Rosæ.
,, Capsici.
,, Cetacei.

Note.—Additional products of the Sperm Whale.—*Ambergris* (*Ambra grис.*)—The indurated fæces, probably somewhat altered by disease, of the Sperm Whale. *Characters*—A solid, opaque, greyish, striated substance, having an odour of musk. S.G. 0·908 to 0·920. *Chemistry.*—*Ambreine* (85 per cent.), a peculiar, non-saponifiable fat resembling cholesterol, soluble in alcohol; benzoic acid (2·5 per cent.); sodium chloride (1·5 per cent.) and other matters.

Sperm oil (*Oleum Spermæ, Oleum Cetacei*) is the liquid oil obtained from the head-cavities (which yield also spermaceti) and blubber of the sperm whale. It is a clear, thin, and neutral oil, of a pale-brown colour, possessing but little odour; it does not become thick on exposure to air, and the best oil remains fluid at 38° F. S.G. 0·875 to 0·883. Chemically, sperm oil is a liquid wax,; it contains no glycerides but fatty acids, probably of the oleic series, are present, combined with alcohols. About 40 per cent. of free alcohols also exist in the oil, the nature of which is not yet known. It is largely used as a lubricant, being especially suited for that purpose on account of its freedom from any tendency to become thick or rancid on exposure. Sperm oil is liable to adulteration, but this in general is easily detected. Admixture of vegetable and animal oils increases the S.G. and saponification value; mineral oils increase the amount of unsaponifiable matter. Adulteration with a mixture of fatty and mineral oil would not be discovered by these methods; usually, however, the flash-point of oil would be lowered and the hydrocarbons can be detected in the unsaponifiable matter.

Allied Marine Oils.—*Doegling oil* (*Bottle-nose Oil*) is obtained from the Bottle-nose Whale, *Hyperöodon rostratus*, and is known in commerce as *Arctic sperm oil;* it is in all respects very similar to sperm oil.

Whale oil (*train oil*) is obtained from the blubber of Balæna Mysticetus (*the Right or Greenland Whale*) and allied species. It has a disagreeable fishy odour, is yellow or brown in colour, and deposits stearin when cooled, has drying properties and consists almost exclusively of glycerides. S.G. 0·924 to 0·929.

Porpoise oil is obtained from Delphinus phocæna (*black porpoise*) and from other marine species. It much resembles whale oil, but contains free alcohols.

Dolphin oil is obtained from Delphinus Delphis (globiceps); it contains spermaceti, but in other respects is similar to porpoise oil.

Seal oil, from various species of Phoca, has S.G. 0·925 to 0·930, and has been used as an adulterant of cod liver oil.

Dugong oil is obtained from the blubber of the herbivorous cetacean, Halicore australis and H. indicus, inhabiting the shallow waters of tropical seas, especially shores of Indian, Malayan, and Australian seas. A full-grown dugong (eight to twelve feet long, and weighing about one ton) yields from ten to twelve gallons of oil.

Shark oil, from the liver of Squalus maximus and other fish, has been used by curriers as a substitute for cod liver oil. It has S.G. 0·870 to 0·880 is of a clear yellow colour and contains much unsaponifiable matter.

OLEUM MORRHUÆ.—Cod Liver Oil.—

The oil extracted from the fresh liver of the cod, Gadus Morrhua, *Linn.* [*Brandt and Ratzeburg, Med. Zool.* vol. ii. tab. ix. fig. 3], by the application of a temperature not exceeding 180° F. (82·2° C.); and from which solid fat has been separated by filtration at about 23° F. (—5° C.)

CLASS—PISCES.

N.O.—Teleostea. *Family.*—Gadidæ.

Syn.—Oleum Jecoris Aselli.

B.P. Characters and Tests.—Pale yellow, with a slight fishy not rancid odour. S.G. 0·920 to 0·930. Readily soluble in ether and chloroform, and slightly soluble in alcohol (90 per cent.). A drop of sulphuric acid added to a few drops of the oil on a porcelain slab develops a violet coloration. When nitric acid is carefully poured into some of the oil contained in a test-tube, a precipitate of coagulated albumen should be formed at the surface of contact of the two liquids. No solid fat should separate on exposure of the oil for two hours to a temperature of 32° F. (0° C.).

Note.—The oil should be only slightly acid to litmus paper when moistened with alcohol. If two or three drops of fuming nitric acid be allowed to flow alongside ten or fifteen drops of the oil contained in a watch glass, a red colour should be obtained at the point of contact. On stirring the mixture with a glass rod this colour becomes bright rose-red, soon changing to lemon-yellow (distinction from *seal oil* which at first shows no change of colour and from *other fish oils* which become at first blue and afterwards brown and yellow).—U.S.P. Cod liver oil is remarkable for the great increase of temperature produced by treating it with sulphuric acid and for its high iodine absorption. These characters distinguish it from most other oils except liver oils.

Method of Preparing Cod Liver Oil.—Previous to the introduction—about forty years ago—of the steam process (*see* below) for making cod liver oil the methods of manufacture may be summed up in the word, "putrefaction." The livers of the cod, after removal, were thrown into barrels which when full, were headed up and kept until the end of the season, when they were carried off by the fishermen to their homes. The livers by this time would be in a state of putrefaction, varying in extent with the time which had elapsed after being "barrelled" and with the temperature to which they had been subjected. By the bursting of the hepatic cells of the livers a certain amount of oil would by this time have been set free to float on the top of the barrel: this, if present in sufficient quantity, would be skimmed off and set aside as *raw medicinal oil*, which is a pale-yellow product of a not unpleasant taste and odour. The contents of the barrel would now be stirred, and after the lapse of a few days or weeks, the surface oil again skimmed off, the product this time being known as *pale oil*. A repetition of the stirring and further exposure to weather, now much warmer, resulted in the production of a third skimming—*pale-brown oil*. The three qualities of oil thus obtained are collectively known as *natural oil*, and owe their differences in properties and colour to the varying proportions of putrefactive products present in them. When no further skimmings of oil could be obtained the dregs of the barrels were thrown into iron pots and subjected to a heat considerably above 100° C. The product thus obtained after straining from the remains of the livers is known as *brown oil*, and finds use chiefly amongst curriers. Brown oil is also produced from the dregs obtained in steam factories, and this differs but little from

that yielded in the natural oil making process. Natural oil produced in the manner described above is still largely manufactured especially in those parts of the coasts where the supply of livers is not sufficient to warrant the erection of steam factories.

The "steam process" of preparing cod liver oil has now been in use for over forty years, and by far the larger proportion of the oil used in British medicine is procured by means of it. The process consists in the use of steam heat for removing the oil from the fresh livers, the heat being supplied either by means of a water-bath, of a steam-jacketed pan or of live steam. On ship-board a considerable quantity of oil is produced by passing steam into a wooden cask-like vessel filled with livers; the method affords the quickest yield of oil in the minimum of time. After the oil has been set free from the liver, by means of the heat employed, it is drawn off and may be cooled down till the higher melting-point fats crystallize; these are then removed by filtering. The remains of the livers may be pressed and so made to yield more oil (of a dark colour and inferior quality), or are used for obtaining brown oil in the same manner as is adopted in the manufacture of natural oil. Bleaching by exposure to the sun's rays is said to be used by some manufacturers, but since it is carried on with a view of removing colour from dark-coloured oils, it is a process which cannot be recommended.

Comparison of Oils of different Countries.—The bulk of the oil of commerce is obtained from Norway, whence the finest oil is obtained. Cod liver oil has been, and is still produced in Iceland, Great Britain, Russia, Japan and North America (Newfoundland). In the case of the first three-named countries, in the absence of supply sufficient to keep steam factories going, much of the oil is of the natural class, and even when steam-prepared is of an inferior quality. In Newfoundland the production of cod liver oil has increased very considerably of late years, the quality however although improved is still much below that of the best Norwegian oils. It is probable that in the recurring periods of scarcity of the latter, Newfoundland oil is largely mixed with or substituted for Norwegian. American "*shore oil*" corresponds to the steam-prepared Norwegian. "*Straits oil*" is a natural oil, and "*banks oil*" resembling brown oil is unfit for medicinal use. Steam-prepared Japanese oil, from the liver of the Japanese codfish (GADUS BRANDTI), has now for some years been offered, but has so far not met with much favour in European markets.

Adulterations of Cod Liver Oil.—Oils from the livers of fish allied to the cod have been, and still are to some extent, used for the purposes of adulteration, as also are seal oil, whale oil, skate oil and shark oil. Adulteration may occur either from the use of livers other than those of the cod or from the admixture of foreign oils with the finished cod oil. Haddock oil of British manufacture has been substituted for cod liver oil in this country. In Lofoten, which is the source of the finest Norwegian oil, adulteration by admixture of other livers is highly improbable since, during the winter fishing season, cod-fish forms the only available material from which oil of any kind can be procured; any adulteration which takes place must, therefore, be by addition of foreign oils.

Chemistry of Cod Liver Oil.—Cod liver oil contains *glycerides* of *stearic* and *palmitic* acids, and according to the researches of Heyerdahl, now usually accepted, glycerides of two unsaturated fatty acids *jecoleic acid* and *therapic acid*, these are said to be present to the extent of 20 per cent. in each case. The same chemist attributes the rancidity of cod liver oil not to the presence of free fatty acids, but to the conversion of jecoleic and therapic acids into hydroxyl acids (to this, he says, they are

peculiarly liable), and he advocates the complete exclusion of air from the oil during manufacture. Small amounts of glycerides of volatile fatty acids are also present, together with free fatty acids which may vary from 0·36 per cent. in the best steam prepared oil to from 20 to 50 per cent. in natural oils. There are also present small quantities of *cholesterol*, colouring matter (*lipochrome*, found also in palm oil), and in "natural" oil the following alkaloids belonging to the class of leucomaïnes, viz., *butylamine*, *amylamine*, *hexylamine*, *dihydro-lutidine*, together with the fixed bases, *aseline* and *morrhuine*. Traces of bromine, iodine, and phosphorus are are also present; iodine to the extent of from three to four parts in one million parts. In addition to the above, traces of inorganic salts, chlorides, sulphates and phosphates of lime, magnesia and soda, etc., are found. The *gaduin* of De Jongh was probably a decomposition product produced in course of analysis. The substance *morrhuol*, obtained by Chapoteaut from cod liver oil (more especially the brown and pale-brown varieties) is probably a mixture of the putrefactive products formed by exposure of the livers before removing the oil.

Uses, etc.—As nutrient and demulcent in cases of impaired nutrition or defective digestion; given in emulsion, in capsules, and mixed with malt extract, etc. *Dose.*—1 to 8 drachms.

10. SACCHARINE SUBSTANCES, STARCHES, Etc.

Under this head are included substances which are, in the majority of cases, the reserve food materials of the plants which yield them; they are nearly allied chemically—many of them belonging to the class of bodies known as carbohydrates. This term, which is applied to compounds having the empirical formulæ, $C_6H_{12}O_6$, $C_6H_{10}O_5$ and $C_{12}H_{22}O_{11}$, containing hydrogen and oxygen in the same proportion as in water, is somewhat misleading, since it in no way represents the constitution of these substances.

SACCHARUM PURIFICATUM.—Refined Sugar.—A crystallised sugar, $C_{12}H_{22}O_{11}$, obtained from the juice of the sugar-cane.

Syn.—Sucrose.

Characters and Tests.—Colourless and inodorous separate crystals. Readily and completely soluble in half its weight of water, forming a clear bright syrup. When the syrup is heated to about 180° F. (82·2° C.) with solution of potassio-cupric tartrate or with solution of copper sulphate and excess of solution of potassium hydroxide, there should not result more than a trace of a red or yellowish precipitate (absence of glucose). Refined sugar should yield no reaction with the tests for calcium, chlorides, and sulphates.

Method of Production, etc.—Cane sugar is obtained from SACCHARUM OFFICINARUM (*N.O.*—Graminaceæ). Recently collected sugar-cane yields 80 per cent. of juice, containing 16 to 21 per cent. of sugar. The juice is neutralised with lime, and concentrated by rapid evaporation in open pans, cooled, and the granular solid product, which constitutes "raw or muscovado sugar," is separated; the liquid portion is known as "treacle" or "molasses." The raw sugar is dissolved in water and purified in a variety of ways. The clear colourless liquid is then concentrated in vacuum pans, and when sufficiently strong, poured into conical moulds and allowed to crystallise, drain and dry. It is then known as loaf sugar. The yellow tint of inferior sugars is often neutralised by the addition of a little inert blue colouring matter. Of purifying agents, albumen (blood, etc.), sulphuric acid and animal charcoal are said to be used. Sugar is also obtained from the *sugar-beet* (BETA VULGARIS. *N.O.*—Chenopodiaceæ), from the *Chinese sugar maple* (SORGHUM SACCHARATUM. *N.O.*—Graminaceæ), and from the *sugar maple* (ACER SACCHARINUS. *N.O.*—Aceraceæ), and is widely distributed throughout the vegetable kingdom.

Chemistry.—Pure sugar has the formula $C_{12}H_{22}O_{11}$. It is soluble in water, insoluble in alcohol, melts at 160° C. and by exposure to light and by the action of dilute acids, is "inverted," *i.e.*, broken up into a mixture of *dextrose* $C_6H_{12}O_6$, and *levulose*, $C_6H_{12}O_6$.

Adulterations.—Other sugars, such as glucose and colouring substances, prussian blue, ultramarine, etc. Chlorides and sulphates should be absent, and its aqueous solution should not be tinged with a yellow colour.

B.P. Preparations.

Confectio Rosæ Gallicæ.
,, Sennæ.
Ferri Carbonas Saccharata.
Liquor Calcis Saccharatus.
Magnesii Sulphas Effervescens.
Mistura Ferri Composita.
,, Cretæ.
,, Spiritus Vini Gallici.
Pulvis Amygdalæ Compositus.
,, Cretæ Compositus.
,, Glycyrrhizæ Compositus.
,, Tragacanthæ Compositus.
Sodii Citro-tartras Effervescens.
Syrupus, 1 in $1\frac{1}{2}$ by weight.
All the Syrups and Lozenges, etc.

Note.—Caramel (*Saccharum ustum*) is obtained by heating sugar to about 200° C. It is a dark-brown mixture of several uncrystallisable decomposition products. Used as a colouring agent.

Saccharum Hordeatum (*Barley-sugar*) is simply sugar heated to about 160° C., with or without the addition of a little tartaric acid, infusion of malt or cream of tartar, and afterwards cooled.

Saccharum Candidum (*Rock* or *Sugar Candy*) consists of large transparent crystals of sugar of a brown or white colour. It is obtained by slow crystallisation from moderately strong solutions of sugar.

Glucose, $C_6H_{12}O_6$ (*Grape sugar, dextrose*), is present in ripe fruits and elsewhere in the vegetable kingdom, where it is usually associated with levulose; it also occurs in most animal fluids. It may be most readily obtained by the action of boiling dilute sulphuric acid on starch; so obtained, it may contain dextrin, which is the body formed intermediately during the conversion of starch into glucose. It differs from cane-sugar in causing a red precipitate of cuprous oxide when added in solution to a hot alkaline tartrate solution of a copper salt. In both the solid and liquid condition it is largely used as a sweetening and preserving agent, and the liquid form is now officially included in Syrup Glucosi (1 in 3) for use as a pill excipient.

Theriaca (*treacle, molasses*) is a syrupy uncrystallisable liquid, of colour varying from golden yellow to brown, obtained as a bye-product in the manufacture of sugar. It is used as a pill excipient.

SACCHARUM LACTIS.—Milk Sugar.—

A crystallised sugar, $C_{12}H_{22}O_{11},H_2O$, obtained from the whey of milk.

Syn.—Lactose.

B.P. Characters and Tests.—In crystals or in crystalline masses, greyish-white, hard, odourless, faintly sweet. Soluble in 7 parts of cold water, and in about 1 part of boiling water. It should not leave more than 0·25 per cent. of ash when incinerated with free access of air. 1 gramme dissolved in 10 cubic centimetres of water gives a red colour with solution of phenol-phthalein after the addition of three drops of the volumetric solution of sodium hydroxide (limit of lactic acid).

Method of Production, etc.—According to Thorpe lactose is manufactured in Switzerland on the large scale by the following process:—50,000 litres of whey are directly evaporated to dryness; the residue, weighing about 1,650 kilos., is dissolved in water at 65° C. in copper pans, three-quarters to one kilo. of alum is added, the solution is filtered through animal charcoal, boiled down to a syrup and allowed to crystallise on wooden rods.

The yield is 55 to 60 per cent. of the crude sugar. Cows' milk contains from $4\frac{1}{2}$ to 5 per cent. of milk sugar. The whey which is used for obtaining it is produced by adding acids to the milk; these have the effect of curdling it, *i.e.*, separating the fat and casein in clots.

Chemistry.—*Lactose*, $C_{12}H_{22}O_{11},H_2O$, crystallizes with one molecule of water, which may be removed by heating to 130° C. It is less soluble in water than cane sugar, and less sweet; is dextro-rotatory; is turned brown by alkalies, reduces Fehling's solution, but does not undergo alcoholic fermentation. It gives no precipitate with neutral cupric acetate in the cold nor when the mixture, after the addition of acetic acid, is boiled (distinction from glucose). When boiled with diluted sulphuric acid it splits up into a mixture of dextrose and isomeric *galactose*. It dissolves lime and other bases forming octoacetates. By heating strongly it is converted into caramel.

Uses, etc.—As nutrient and demulcent; also as sweetening agent and for reducing and mixing with more active drugs.

B.P. Preparations.

Extractum Nucis Vomicæ.
„ Physostigmatis.
„ Strophanthi.
Pulvis Elaterini Compositus.

Note.—Lactic acid is usually prepared by the lactic fermentation of sugar, and is hence found in sour milk, where it is the result of the action of a species of Bacillus (*B. acidi lactici*) on the lactose.

Cane sugar may be detected by the following test (U.S.P.).—If about 1 gramme of powdered milk sugar be sprinkled upon about 5 cubic centimetres of cold sulphuric acid (S.G. 1·840) contained in a flat-bottomed dish and covered with a watch-glass, the acid may acquire a greenish or reddish but no brown or blackish-brown colour within half-an-hour (absence of *cane-sugar*).

MEL.—Honey.—A saccharine secretion deposited in the honeycomb by Apis mellifica (the hive or honey bee).

CLASS—INSECTA.

N.O.—Hymenoptera.

Characters and Tests.—When recently separated from the honeycomb it is a viscid translucent liquid, of a light-yellowish or brownish-yellowish colour, which gradually becomes partially crystalline and opaque. It has a peculiar odour and a very sweet characteristic taste. Boiled with water for five minutes and allowed to cool, it does not become blue with solution of iodine (absence of *starch*). Incinerated it should not yield more than 0·2 per cent. ash, the solution of which in water acidulated with nitric acid should not afford more than a slight turbidity with barium chloride (absence of *foreign inorganic matter* and of *sulphate* indicating commercial glucose).

Note.—The best *virgin* honey is obtained by allowing the cut comb to drain at the ordinary temperature, but by pressing the residual wax, a less pure variety is obtained. The gradual solidification of honey, which is much retarded by keeping it in the dark, is due to the separation of the dextrose. Pure honey has S.G. over 1·370, and when diluted with twice its weight of water, a syrup having density from 1·101 to 1·115 is produced, corresponding to about 72 and 82 parts per cent. respectively of sugar in the original honey. *Mead* is prepared by the vinous fermentation of diluted honey.

Chemistry.—Moisture, 12 to 23 per cent.; sugar, consisting of *dextrose* and *levulose*, 70 to 80 per cent.; *sucrose* is sometimes present in small

proportion in new honey; non-saccharine matter (wax, pollen, traces of volatile oil, insoluble and mineral matters) about 5 per cent. Mannite is also sometimes present, and all honey is said to contain a small quantity of formic acid, which gives it its good keeping qualities.

Uses, etc.—As demulcent and laxative; also as adjuvant and vehicle; formerly official, now substituted by clarified honey, Mel depuratum, which is used in making Mel boracis, P.B.

Note.—Adulteration of Honey.—In addition to starch and glucose, for the detection of which the B.P. gives tests, both cane sugar and dextrin have been used to sophisticate honey. The former may be detected by determining the amount of glucose present before and after "inversion," the difference giving the amount of cane sugar present. Dextrin, added alone or present in added glucose, may be detected by mixing the honey with an equal quantity of water and adding to the mixture four times its volume of alcohol, which, if dextrin be present, causes the precipitation of white flocculi.

MANNA.—Manna.—A concrete saccharine exudation obtained by making transverse incisions in the stems of cultivated trees of Fraxinus Ornus, *Linn.*, and F. rotun difolia, *Lam.*

N.O.—Oleaceæ.

Habitat.—Sicily.

Characters and Tests.—In stalactitic pieces, varying in length and thickness, flat or concave on their inner surface; of a pale yellowish-brown colour, irregularly convex, and nearly white externally. This manna, which is known as flake manna, is crisp, brittle, porous, and crystalline in structure. Odour faint, resembling honey; taste sweet and honey-like, combined with a slight acridity and bitterness. It consists principally of mannite, $C_6H_8(HO)_6$, together with common sugar and indefinite matter. The mannite, which forms from 60 to 80 per cent. of the manna, may be extracted by boiling with fifteen or sixteen parts of alcohol, from which it will afterwards separate on cooling in colourless, shining crystals; it requires five parts of cold water for its solution, and this does not undergo vinous fermentation in contact with yeast. Manna contains about 10 per cent. of moisture.

Method of Collection, Varieties, etc.—The manna-yielding trees, F. Ornus (flowering ash), F. rotundifolia, are cultivated in Sicily and Calabria. During summer they yield manna by exudation, but the flow is increased by making incisions in the bark The product varies in value according to the time of year when it is collected—that yielded in the summer being the best; thus we have *flake manna*, which has the characters given above, and *sorts manna* (*small manna*), which consists of small tears or fragments, and is obtained in the autumn from the lower parts of the trees.

Chemistry.—Mannite (*mannitol*), $C_6H_8(OH)_6$ (60 to 80 per cent.), gum, dextrin, sugar, resin, extractive matter (said to be the purgative principle), and *fraxin* (a glucoside resembling æsculin). Mannite is a hexahydric alcohol insoluble in cold alcohol and ether. By the action of heat it becomes *mannitan* ($C_6H_{12}O_5$), by the action of oxidising agents it yields *mannose* ($C_6H_{12}O_6$) and levulose, and it may be prepared artifically by the action of reducing agents on dextrose. Mannite is optically inactive, and has no reducing action on Fehling's solution.

Uses, etc.—A mild laxative; formerly official. *Dose.*—60 grains to 1 ounce.

B.P.C. Preparations.—Infusum Sennæ Compositum, Syrupus Mannæ, and Syrupus Mannæ Compositus.

Note.—False and Fictitious Mannas.—A number of these, none of which contains mannite, are known, of which the following may be mentioned:—*Briançon manna*, from Larix europœa, contains a peculiar sugar, *melezitose*. *American manna*, from Pinus lambertiani, contains a peculiar sugar, *pinite*. *Persian manna*, from Alhagi camelorum, contains *melezitose* (*see* above). *Tamarisk manna*, from Tamarix gallica, var. mannifera (Persian), contains mucilaginous sugar. *Oak manna*, from Quercus valonia (Kurdistan). *Australian manna*, from Eucalyptus mannifera (New South Wales), contain *melitose* isomeric with glucose. Fictitious manna appears to be prepared with

potato sugar, *i.e.*, sugar obtained from potato starch by means of ebullition with dilute sulphuric acid. As this acid is subsequently neutralized with lime, there is generally present some calcium sulphate, which would be present in the ash left on ignition. *Sorbin* ($C_6H_{12}O_6$) is a fermentable sugar contained in the fruit of the mountain ash, SORBUS AUCUPARIA.

AMYLUM.—Starch.—The starch procured from the grains of common wheat, Triticum sativum, *Lam.*; maize, Zea Mays, *Linn.*; and rice, Oryza sativa, *Linn.*; [*Bentl. and Trim. Med. Pl.* vol. iv. plates 291 to 296].

N.O.—Graminaceæ.

Habitat of Triticum sativum.—Cultivated in all temperate parts of the world.

Habitat of Zea Mays.—America, Africa and India, etc.

Habitat of Oryza sativa.—Cultivated in sub-tropical countries.

B.P. Characters and Tests.—In fine powder or in irregular angular or columnar masses, which are readily reduced to powder; white, inodorous. When lightly rubbed in a mortar with a little cold *water*, the mixture is neither acid nor alkaline to *test-papers*. Boiled with *water* and cooled, it gives a deep blue colour *with solution of iodine*. Under the microscope the several varieties of Starch present the following characters:—1. Wheat starch: A mixture of large and small granules, the former lenticular in shape, and marked with faint concentric striæ surrounding a nearly central hilum. 2. Maize starch: Granules more uniform in size, frequently polygonal, somewhat smaller than the large granules of wheat starch, and having a very distinct hilum but no evident concentric striæ. 3. Rice starch: Granules extremely minute, nearly uniform in size, polygonal, without evident hilum or striæ. The starch should be free from granules other than those described.

Note.—For excellent plates illustrating the structure of starch grains *see Attfield's Chemistry* or *Allen's Commercial Organic Analysis, vol. I.*

Mode of Preparation, etc.—The average percentage of starch present in the three kinds of grain enumerated by the B.P. is, in wheat—54 to 56 per cent.; maize—54 to 58 per cent.; rice—75 to 77 per cent. In preparing starch from wheat, it is usual to allow fermentation to set up first in order that the lactic acid formed may soften and partly dissolve the glutinous envelopes in which the starch grains are imbedded. This is done by macerating the grain in warm water for a few days, crushing it by hydraulic pressure and subsequently elutriating the mass with successive quantities of water. The milky liquor obtained is then allowed to stand till fermentation sets up and the starch is afterwards washed by decantation. Finally the liquor is stirred to keep the starch in suspension, and passed through fine sieves which allow the passage of the purified starch. This is drained on linen cloths and dried at a gentle heat. Starch is also prepared from wheat-flour without fermentation—a dough made from the flour is washed with special apparatus until all starch is removed. The starch is allowed to deposit and afterwards purified by washing with a solution of sodium hydroxide.

Chemistry.—Pure starch has the empirical formula, $C_6H_{10}O_5$. The layers of the grain consist of an outer

thin portion of *starch cellulose* surrounding the inner *starch-granulose*. These substances may be separated by washing the crushed grains with cold water, by which means the granulose is removed, the starch-cellulose being left behind. Starch is insoluble in cold water, in alcohol, and in all other liquids. When boiled with water the grains swell, burst, and partially dissolve to form a solution from which alcohol precipitates a white powder, *soluble starch*. Boiled with dilute sulphuric acid, starch becomes converted into a mixture of dextrin and dextrose; if the boiling be prolonged or be carried on under increased pressure, dextrose alone is the final product. By the action of extract of malt (which contains diastase) starch is converted into a mixture of dextrin and maltose, the proportion of these varying according to the temperature made use of. Heated from 160° to 200° C., starch becomes converted into dextrin. Starch paste, starch granulose, and soluble starch give a blue colour with iodine; starch cellulose a yellow.

Uses, etc.—As demulcent and vehicle for all kinds of medicaments; externally to skin, for drying, etc.

B.P. Preparations.

Glycerinum Amyli - - - - - 1 part in 9.
Pulvis Tragacanthæ Compositus.

OTHER STARCHES.—The starches are arranged by Allen into five classes, as follows:—

1. THE POTATO GROUP, including *potato starch*, *tous-les-mois* (from CANNA GIGANTEA), *arrowroot*, Bermuda, St. Vincent and Natal, from the rhizome of MARANTA ARUNDINACEA (*N.O.*—Marantaceæ), and *East Indian arrowroot* or *Curcuma starch*, from CURCUMA ANGUSTIFOLIA (*N.O.*—Scitaminaceæ).

2. THE LEGUMINOUS GROUP, including the starch of the *bean*, *pea*, *lentil*, etc.

3. THE WHEAT GROUP, including starches from *wheat* and some other cereals, and from certain medicinal plants as *jalap*, *rhubarb*, etc.

4. THE SAGO GROUP, including the starch made from the sago palms, various species of SAGUS, *tapioca*, *Cassava starch*, from MANIHOT UTILISSIMA (*N.O.*—Euphorbiaceæ), *arum starch*, and that from many drugs.

5. THE RICE GROUP, including those starches having the smallest grains, viz., that of *oats*, *maize*, *ipecacuanha*, etc.

The members of each group have physical characters in common; for particulars of these the student may turn to *Allen's Commercial Analysis, vol. I.*

Corn-flour.—The so-called Indian corn-flour is prepared from maize.

FARINA TRITICI.—Wheaten Flour.—The grain of Triticum sativum, *Lam.*, ground and sifted.

N.O.—Graminaceæ.

Habitat.—Cultivated in all temperate parts of the world.

Characters.—A very fine white powder, without odour and of an insipid taste. Under the microscope the starch granules, of which it is

largely composed, are seen to be as described under "Amylum," No. 1. (*See* Amylum).

Note.—The husk or *bran* of wheat constitutes 25 to 33 per cent. of the whole, and contains the greater part of the mineral matter (phosphates, etc.) present in the grain.

Chemistry.—The following figures give the average percentage of whole wheaten flour;—Moisture, 11·1; starch, 62·3; fat, 1·2; cellulose, 8·3; gum and sugar, 3·8; albuminoids, 10·9; ash, 1·6. The albuminoids present are commonly known under the name *gluten*, but consist of two proteins, viz., *glutenin* and *gliadin* (soluble in dilute alcohol), it is to the presence of this latter that the flour owes its adhesive qualities. The ash of wheat flour consists largely of phosphates, including aluminium phosphate.

Uses, etc.—Nutrient, demulcent, etc,; formerly official, and used in the production of Cataplasma fermenti.

Note.—*Mica panis* (bread crumb) has been used as a pill excipient. *Vermicelli* and *macaroni* are prepared from wheaten flour.

TAPIOCA.—Tapioca.—The dried starch deposited from the expressed juice of the rhizome of the Cassava plant, Manihot utilissima (Jatropha Manihot), *Pohl.*, and Manihot Aipi, *Pohl.*

N.O.—Euphorbiaceæ.

Habitat.—South America.

Characters.—Irregular, hard, white, rough grains, possessing little taste, partially soluble in cold water, and affording a fine blue colour when iodine solution is added to its filtered solution. The entire granules under the microscope are seen to be muller-shaped.

Uses, etc.—As nutrient.

Chemistry.—Starch, etc.

Note.—There are two varieties of the tapioca-yielding plant—the sweet cassava M. utilissima and the bitter M. Aipi—the latter containing hydrocyanic acid. The roots are tubercular and abound in a milky juice; both yield cassava meal, which is the pounded residual cake left after expressing the juice from the rasped roots. *Cassava bread* is made from the meal in the usual way, and differs from our bread in the valuable property of keeping any length of time, and hence is the staple food of tropical South America. *Tapioca meal* is the starch deposited from the expressed juice, washed, and dried without heat. Tapioca is obtained by drying the moist meal on hot plates. *Casaveen* is a sauce prepared from the juice by boiling with condiments; it is blackish and viscid, hydrocyanic acid is got rid of by the boiling. The sweet root is eaten at table; and the bitter (after drying) with the sweet roots are eaten by cattle.

SAGO.—Sago.—The fecula obtained from the pith of the Sago palm, Arenga saccharifera (Saguerus Rumphii), *Labill.*

N.O.—Palmaceæ.

Habitat.—East Indian and Polynesian Islands.

Characters.—Occurs occasionally as a whitish glistening powder or in irregular grains of variable tint, and distinguished as white and brown sago; but is frequently seen as *pearl-sago* in the form of globular grains, about the size of a pea or less, pearl-like in appearance, with a smooth surface, and occasionally showing two or more grains adhering together. The starch granules under the microscope are seen to be irregularly ovate, oval, or elliptical, and often with a roughish surface; the hilum is small and circular and located near one end.

Uses, etc.—As nutrient.

Chemistry.—Starch, etc.

Note.—The tree is felled, split lengthwise, the pith removed, powdered and washed with water to remove woody tissue. The fecula subsides and constitutes *sago-meal.* This is granulated by passing it, when damp, through a sieve, the globular pieces dropping into a shallow post suspended over a fire, where they are dried by constant stirring. A single tree will yield as much as 500 to 600 pounds of sago meal. A sugar called *jaggary* is obtained in large quantities from the juice of this tree.

SECTION III.

DRUGS OF ANIMAL ORIGIN.

Under this head are included those drugs which consist of whole animals or of animal tissues, animal secretions, etc. Fats and fatty oils of animal origin have already been described.

1. ANIMALS.

CANTHARIS.—Cantharides.—The dried beetle, Cantharis vesicatoria, *Latr.* [*Brandt and Ratzeburg, Med. Zool.* vol. ii. tab. xviii. figs. 1, 2, 3].

CLASS—INSECTA.

N.O.—Coleoptera.

Syn.—Lytta vesicatoria; Meloë vesicatorius; Spanish flies; Muscæ Hispanicæ.

Habitat.—Southern and Central Europe.

B.P. Characters.—From about three-quarters of an inch to an inch (eighteen to twenty-five millimetres) long, and a quarter of an inch (six millimetres) broad, with two long elytra or wing-sheaths of a shining green or coppery-green colour, under which are two thin brownish transparent membranous wings; odour strong and disagreeable.

Collection, etc.—Cantharides is collected in Hungary, France, Spain, Russia and Sicily; the Russian variety being most esteemed. The beetles are usually collected early in the morning, when persons with covered heads and faces shake them off the trees (ash, lilac, privet, etc.), plunge them into vinegar, or expose them in sieves to the vapour of vinegar and then dry them in the sun or in warmed compartments. As they are subject to the ravages of mites and moths (Acarus domesticus and Tinea species, &c.), they should be preserved in well-closed vessels containing a little camphor. Both the male and female are official. The green colour of the elytra is said to be due to chlorophyll.

Chemistry.—Cantharidin, $C_{10}H_{12}O_4$, the active vesicating principle (0·4 to 1 per cent.) is the lactone or anhydride of cantharidic acid; green oil; a fatty matter; free acetic and uric acids and phosphates of calcium and magnesium.

Cantharidin is a tasteless, odourless, crystallisable solid, capable of sublimation (120° C.) and insoluble or only sparingly soluble in water. Cold alcohol dissolves it slightly, but hot alcohol freely. It is soluble in ether and acetic ether, especially when warmed. Chloroform and acetone are its best solvents. It is soluble in the fixed alkalies and also in strong acetic, sulphuric and nitric acids with warmth, but it is deposited unchanged from these acids when the solutions are cooled. With the elements of water, cantharidin acts as an acid and in fact exists in the flies partly in the form of cantharidates. It may be thus prepared:—Powder the beetles, and after acidification with hydrochloric or sulphuric acids exhaust with chloroform or acetone; on evaporation of the solvent a mixture of cantharidin and fat is obtained from which the latter is removed by washing with cold petroleum spirit. Finally recrystallize from alcohol.

B.P. Preparations.

Acetum Cantharidis	-	1 part in	10.
Emplastrum Calefaciens	-	1 ,,	25, nearly.
,, Cantharidis	-	1 ,,	3.
*Liquor Epispasticus	-	1 ,,	2 of acetic ether.
Tinctura Cantharidis	-	1 ,,	80 of alcohol (90 per cent.)
Unguentum Cantharidis	-	1 ,,	10.

**Used in preparing*
Collodium Vesicans.

Preparations other than B.P.—Cantharidin and Liquor Epispasticus Concentratus (1 in 1) are included in the B.P.C. which also gives formulæ for preparations of Cantharidin representing each of the official preparations of Cantharides but possessing the advantage of uniformity of strength in active principle.

MYLABRIS.—Chinese Cantharides.—The dried insect Mylabris phalerata *Pallas* and M. cichorii *Fab.* (Chinese blistering flies).

CLASS—INSECTA.

N.O.—Coleoptera.

Habitat.—Eastern and Southern Asia. It is of common occurrence throughout India.

Characters.—About one inch long and one-third of an inch broad; the elytra (as is characteristic of the genus) are of an obscure yellow colour, and with three large, somewhat zig-zag, transverse (black) bands. The first band is interrupted and sometimes reduced to three or four spots.

Chemistry.—Contain more than one per cent. of *cantharidin.*

Uses, etc.—As cantharides, and are official in the Indian and Colonial Addendum as a substitute for Spanish flies.

Note.—CANTHARIS VITTATA (*potato fly*), an insect indigenous in the U.S., has a red head with dark spots, black elytra, with a yellow median stripe and margin. It contains about 1·3 per cent. of cantharidin. CANTHARIS CINEREA (*ash-coloured cantharis*), C. MARGINATA, C. ATRATA (*black cantharis*) are, with other species of vesicating beetles, found in the United States.

HIRUDO.—Leeches.—(1) Sanguisuga medicinalis, *Savigny*, the Speckled Leech [*Brandt and Ratzeburg, Med. Zool.* vol. ii. tab. xxviii. fig. 34]; and (2) Sanguisuga officinalis, *Savigny*, the Green Leech [*Brandt and Ratzeburg, Med. Zool.* vol. ii. tab. xxx. fig. 1].

CLASS—ANNELIDA.

N.O.—Hirudinea.

Habitat.—South of Europe. Imported from Bordeaux, Lisbon and Hamburg.

B.P. Characters.—Body soft, smooth, two inches, (five centimetres) or more in length, tapering to each extremity, plano-convex, marked with from ninety to one hundred fine annulations; back olive-green with six rusty-red longitudinal stripes. The anterior end is terminated by a small sucker surrounding the tri-radiate jaws, and the posterior end by a large sucker. (1) Ventral surface greenish-yellow, spotted with black; (2) Ventral surface olive-green, not spotted.

Uses, etc.—For drawing blood; a good specimen will remove between 60 and 120 grains.

Note.—Leeches should be preserved in clean soft water in a cool place and moss, stones, etc., should be provided, in order that the animals may, by passing their bodies through these, remove the slime which would otherwise accumulate. Gorged leeches may be made to yield up the blood by immersion in salt water; they should be kept separate from the others.

COCCUS.—Cochineal.—The dried fecundated female insect, Coccus Cacti, *Linn.* [*Brandt and Ratzeburg, Med. Zool.* vol. ii. tab. xxvi.], reared on Nopalea coccinellifera, *Salm-Dyck* [*Bart. Fl. Bras.* vol. iv. pt. ii. tab. lx.], and on other species of Nopalea.

CLASS—INSECTA.

N.O.—Hemiptera.

Syn.—Coccionella; Coccus Cacti.

Habitat.—Mexico, West Indies, Teneriffe, etc.

B.P. Characters and Test.—About one-fifth of an inch (five millimetres) long; somewhat oval in outline, flat or concave beneath, convex above, transversely wrinkled, purplish-black or purplish-grey, easily reduced to powder, which is dark-red or puce-coloured. When Cochineal is macerated in *water* no insoluble powder is separated. Incinerated with free access of air, it should yield not more than 6 per cent. of ash.

VARIETIES, ETC.—There are three varieties known in commerce, viz:—

1. *Silver-grain*, which is the kind most commonly met with and which has a silvery appearance, due to the waxy covering being retained owing to the insects being killed by sulphur fumes and without heat.

2. *Black-grain*, which is dark-brown in colour, is produced if the insects are killed by boiling water, the wax being thus removed.

3. *Granilla*, an inferior kind, made up of small and imperfect insects.

Note.—Cochineal insects are reared on the *nopal*, NOPALEA COCCINILLIFERA (*N.O.*—Cactaceæ), a plant with flattened elliptical branches. The impregnated females are placed on this plant, and they there deposit their young. After a few months, when the females are fecundated, they are brushed off, killed, and then dried. Three harvests are annually gathered—the female alone being collected. Of the two commercial kinds, black-grain and silver-grain, the former are now considered to be the better. The male insect is about half the size of the female, its body terminating posteriorly in two long divergent setæ. When macerated in water the insect swells up considerably, and its shape and three pairs of legs become visible. Seventy thousand insects go to make one pound of cochineal.

Chemistry.—*Carminic acid*, $C_{17}H_{18}O_{10}$ (the colouring principle, also known as *cochinillin* or *coccionellin*), is the most important constituent. There are also present water, nitrogenous matter, fat and wax (*coccerin*, myristin, etc.) and ash. Carminic acid is a glucoside, breaking up on hydrolysis into *carmine-red* and a sugar. It forms purple salts with alkalies.

Uses, etc.—As colouring agent; as indicator in acidimetry; also largely in the arts as a dye.

B.P. Preparations.

Tinctura Cardamomi Composita	- -	1 part in 160.
,, Cinchonæ	- - - -	1 ,, 320.
,, Cocci	- - - - -	1 ,, 10 of alcohol (45 per cent.).

B.P.C. Preparations.—Glycerinum Cocci, Liquor Cocci, Glycerinum Carmini and Liquor Carmini.

Carmine is prepared by precipitating decoction of cochineal with alum or a salt of tin, gelatin, etc. It consists, therefore, of carminic acid with nitrogenous and mineral matters. It is slightly soluble in water, readily in alkaline liquids, ammonia being commonly used for the purpose.

Adulterations of Cochineal.—Such white and heavy powders as barium sulphate, powdered talc and lead carbonate, fixed on the insects with gum to increase their weight, have been used; and bone black and charcoal, similarly fixed, have been used to render the black variety heavier. The drug may be valued (according to Thorpe) by noting the quantity of standard neutral alum solution required to completely precipitate the colouring matter.

2. PROTEINS (ALBUMINOUS SUBSTANCES).

The class of substances included in this group are now generally termed *proteins;* the type of the class is the albumin found in white of egg. All the proteins (albuminoids) contain the five elements—carbon, oxygen, hydrogen, nitrogen and sulphur, differing from one another but little in percentage composition. Many of them *coagulate* when heated, and are precipitated from solution by alcohol, nitric and acetic acids, most metallic salts and other reagents. On incineration they usually leave a trace of ash containing phosphates and other salts. The proteins are divided into a number of groups, of which the following are the more important:—Coagulable by heat, *albumins* (such as egg-albumin), *globulins* (fibrinogen, vitellin); non-coagulable by heat, *sclero-proteins* (gelatin), *peptones* (hydrolytic products of proteins), *proteoses*, etc.

OVI ALBUMEN.—Egg Albumen.—The liquid white of the egg of Gallus Bankiva *var.* domesticus.

CLASS—AVES.

N.O.—Gallinæ.

Characters.—A glairy viscid fluid contained in delicate membranous cells. It is soluble in water, and the aqueous solution is coagulated when heated to about 70° C., the coagulum being no longer soluble in water.

Chemistry.—White of egg contains albumins (*egg-albumin*, etc.) amounting to about 12 per cent., in addition to water (83 per cent.), mucus and traces of other substances. Egg-albumin may be obtained from white of egg by diluting with water, filtering, and adding basic acetate of lead; the precipitate of albumin formed is subsequently treated with carbon dioxide or sulphuretted hydrogen, which remove the lead, leaving the albumin in solution. This solution is now evaporated at 40° C., leaving a white or pale-yellow, brittle and friable, translucent mass. Dried albumin is soluble in water, more readily so if alkali be present. Its aqueous solution is coagulated when heated to about 70° C. Albumin is insoluble in alcohol and ether and is precipitated from solution by nitric and hydrochloric acids, phenol and many metallic salts. It is not precipitated by acetic, carbonic or phosphoric acids. By the action of gastric juices, pepsin and other enzymes, albumin is converted into *peptone*, which is soluble in water and incoagulable by heat.

Uses, etc.—For clarifying liquids, and as antidote to many mineral poisons.

Serum albumin (*blood albumin*) is obtained by separating the clot (*fibrin*) of blood from the liquid portion (*serum*). Both in the liquid condition and reduced to a powder by evaporation, blood serum has been used in medicine as a remedy for anæmia, debility, etc.

OVI VITELLUS.—Yolk of Egg.—The yolk of the egg of Gallus Bankiva *var.* domestica.

CLASS—AVES

N.O.—Gallinæ.

Characters.—A yellow thick liquid, separated in the egg from the white by a delicate membrane. When agitated with water it forms a yellowish milky emulsion. When heated it is converted into a granular solid.

Chemistry.—The globulin *vitellin* (about 15 per cent.) with small amounts of other proteins; fat (about 20 per cent.); cholesterol, *lecithin*, water, colouring matter, salts. Vitellin is an albuminoid belonging to the class of globulins and may be obtained as a residue after treating yolk of egg with water, alcohol and ether; it is insoluble in water but soluble in dilute acids and alkalies and in a 10 per cent. solution of common salt.

Lecithin $C_{42}H_{84}NO_9P$, a substance containing phosphorus occurs also in nerve substance, brain, etc., it has the nature of a highly complex glycerin ester, is soluble in ether and alcohol, and on saponification gives glycero-phosphoric acid, etc.

Uses, etc.—In the preparation of emulsions; as nutrient, etc.

B.P. Preparation.
Mistura Spiritus Vini Gallici.

GELATINUM.—Gelatin.—The air-dried product of the action of boiling water on gelatinous animal tissues, such as skin, tendons, ligaments and bones.

Syn.—Glutin.

Characters.—In translucent sheets or shreds. The solution in hot water is colourless and inodorous, and solidifies to a jelly on cooling. Gelatine is insoluble in alcohol and ether. It dissolves in acetic acid. Its aqueous solution is not precipitated by diluted acids, alum, acetate of lead or perchloride of iron; it is precipitated by tannin.

Chemistry.—Gelatin differs in composition from the albumins having a slightly larger proportion of nitrogen; unlike these also, its aqueous solution is not precipitated by acids nor by heat. When boiled with alkalies or sulphuric acid it is converted into a mixture of bodies containing *glycocoll* and *leucin*. Gelatin does not exist as such in bones, etc., but is formed by the hydrolysis of *collagen* by prolonged boiling with water.

Uses, etc.—As basis for suppositories, in pill-coating, capsule making, etc.

B.P. Preparation.
Suppositoria Glycerini.

Note.—*Gelatin* is chiefly obtained by high-pressure steam from calves' pelt, tendons, ligaments, skins, bones, etc.; the solution thus yielded is filtered, evaporated under

reduced pressure, spread upon plates, dried, and sold in sheets or cut up into shreds. *Glue* is an impure variety of gelatin made from the trimmings of hides. *Size* is glue of an inferior tenacity and softer consistence, and is prepared from the parings of parchment and thin skins. The value of glues and gelatin prepared from skins is greater than the product yielded by bones. Liquid gelatin is prepared by treating gelatin with strong acetic acid, or by boiling it with diluted nitric acid, its power of gelatinization being thus removed.

Keratin is the insoluble residue obtained from horn-turnings, feathers, etc., by treating them first with pepsin (in acid solution) and subsequently with alcohol, ether and dilute acids. It is soluble in ammonia and glacial acetic acid and by evaporation of the solution a viscid liquid is obtained which is used for coating pills. Pills coated in this way are supposed to pass through the stomach unchanged and to dissolve in the small intestine.

Chondrin is a gelatin-like body obtained from bone cartilage (hyaline cartilage); it (*v.f.* gelatin) is precipitated from solution by alum, lead acetate and many metallic salts.

ICHTHYOCOLLA.—Isinglass.—The swimming bladder or sound of various species of Acipenser, prepared, and cut into fine shreads; obtained chiefly from Acipenser Huso (the Beluga) and other species of the Sturgeon, as Acipenser Sturio (the Common Sturgeon). Other genera, as Silurus, Morrhua, Gadus, Otolithus, Lota and Polynemus, also yield isinglass.

CLASS—PISCES.

N.O.—Sturiones, etc.

Characters.—In separate sheets, sometimes rolled, of a horny or pearly appearance; whitish or yellowish, semi-transparent or iridescent, inodorous, insipid; almost entirely soluble in boiling water and in boiling diluted alcohol.

Note.—The organ from which isinglass is obtained is a membranous sac, filled with air, found under the spine in the middle of the back above the centre of gravity. According to the mode of preparation, isinglass passes under the names of *purse*, *pipe*, *lump*, *leaf*, *honeycomb*, *staple*, *book*, and *ribbon isinglass*. Besides the Russian variety (which is considered to be the best) there are Brazilian and East Indian kinds. Fifteen grains of isinglass will render one ounce of water jelly-like.

Chemistry.—Collagen (90 per cent.), giving gelatin when boiled with water; membrane, insoluble in boiling water; with salts of potassium and sodium, and a little calcium phosphate.

Uses, etc.—As nutrient, etc.; formerly included in the U.S.P. for making court plaster.

SERA ANTITOXICA. Antitoxic Serums.

Antitoxic serums consist of the defibrinated blood of animals rendered immune from various diseases by inoculation either with a culture of the micro-organisms causing the disease or with a preparation of the *toxins* produced by them. In the latter case the serum of the animal will be truly antitoxic, *i.e.*, will possess the power of neutralising the toxins produced by bacterial agency; in the former the resulting serum will be bactericidal or will tend to cause the death of the particular bacterium in the circulation into which it is injected.

Antitoxic serums are usually standardised in terms of the number of lethal doses of toxin they are able to neutralise, the unit adopted in the

case of the anti-diphtheritic serum being the amount of antitoxin which will neutralise 100 times the minimum lethal dose of toxin when mixed together and injected subcutaneously into a guinea-pig of standard weight.

The method adopted for the preparation of Antidiphtheric Serum is typical and is follows: -A nutrient material consisting of beef broth is prepared, and to this (contained in a flask of special design) is added a small quantity of a pure bouillon culture of the diphtheria bacillus, the necessary material for the latter being obtained from a patient suffering from the disease. The flask containing the culture and nutrient liquid is kept in an incubator for a period of several days. A sufficient quantity of the required toxin having now been formed, the bacilli are destroyed by the addition of one-half per cent. of carbolic acid, or more frequently are removed by filtration through a Pasteur or similar germ-proof filter. The poison-containing fluid is now injected in gradually augmented doses into the veins of horses kept specially for the purpose, and when the animals are thought to have been by this means rendered sufficiently immune, they are bled. The blood is allowed to coagulate, and the serum, a pale straw-coloured fluid, is preserved by the addition of phenol or tricresol, and stored in small phials. It may also be evaporated to dryness in vacuo, without suffering decomposition, and preserved in this form.

The British Pharmaceutical Codex includes the following serums:— Antidiphtheric (antitoxic), Antipestis (Antiplague—bactericidal and antitoxic), Anti-streptococcic (bactericidal), Antitetanic (antitoxic), Antithyroid and Antivenomous (antitoxic). The U.S.P. recognises the first-named only.

3. GLANDS, GLANDULAR SECRETIONS, ANIMAL EXTRACTS, Etc.

MOSCHUS.—Musk.—The dried secretion from the preputial follicles of Moschus moschiferus, *Linn.* [*Brandt and Ratzeburg, Med. Zool.* vol. i. tab. vii., viii.].

CLASS—MAMMALIA.

N.O.—Ungulata.

B.P. Characters and Test.—In irregular somewhat unctuous grains which have a dark reddish-brown or reddish-black colour, a characteristic, penetrating, persistent odour, and a somewhat bitter taste. The grains are contained in an oval sac, from about one and a half to two inches (three and a half to five centimetres) in diameter, which is nearly smooth on one side and covered on the other or outward side by brownish-yellow or greyish appressed bristle-like hairs, concentrically arranged around a nearly central orifice. Musk should be free from earthy impurities, and should on incineration yield not more than 8 per cent. of ash.

Chemistry.—Stearin, olein, cholesterol, proteins, and free ammonia are present, and may be easily separated. The odoriferous principle has been isolated recently as *muskone*, a ketone in the form of a dark brown volatile oil possessing a pure intense odour of musk. Moisture should not exceed 15 per cent.

Uses, etc.—As stimulant and antispasmodic. *Dose.*—5 to 10 grains. Largely used in perfumery. The U.S.P. and B.P.C. include a tincture, 1 in 20.

Varieties and Adulterations.—There are two varieties, viz., *Chinese* or *Thibet musk* and *Russian* or *Siberian musk*; of these the former is considered more valuable. Musk is largely adulterated, and an artificial musk is extensively manufactured by the Chinese merchants of Canton. It is said to be composed of a mixture of dried blood and ammonia, together with a small quantity of musk, the whole being enclosed in a piece of the skin of the animal. The genuine drug should be contained in sacs answering to the official characters, and these should show no evidence of having been opened and subsequently sewed or glued up.

Civet is an odorous brownish-yellow, fat-like substance obtained from the perineal glands of the civet cat (VIVERRA CIVETTA) and other species of Viverra (*N.O.*—Carnivora). It is imported from Africa and the West Indies and has similar properties to musk and castor, but is used almost exclusively in perfumery.

Note.—Artificial Musk, Musk Baur, is trinitrobutyl-toluene, $C(CH_3)_3.C_6H(NO_2)_3CH_3$. It is a crystalline derivative of butyl-toluene, soluble in alcohol, ether, chloroform, etc., and is used in perfumery as a substitute for natural musk; it has also been used as an antispasmodic.

CASTOREUM.—Castor.—The dried preputial follicles and their secretion, obtained from the Beaver, Castor Fiber, and separated from the somewhat shorter and smaller oil-sacs which are frequently attached to them.

CLASS—MAMMALIA.

N.O.—Rodentia.

Habitat.—Hudson's Bay Territory, also Siberia.

Characters.—Follicles in pairs, about three inches long, fig-shaped, firm and heavy, brown or greyish; containing a dry resinous reddish-brown or brown, highly odorous secretion, in great part soluble in alcohol, and in ether.

Chemistry.—Castorin, a crystalline, fatty, non-saponifiable substance; volatile oil (1 to 2 per cent.); a bitter resin; with fatty (cholesterol, etc.) albuminous and saline matters, mixed with epithelial débris; traces also of salicin and benzoic acid and of phenol are present.

Uses, etc.—As stimulant and antispasmodic. *Dose.*—5 to 10 grains. Formerly official in the B.P. for the preparation of a tincture, 1 in 20 of S.V.R., now contained in the B.P.C.

Note.—The castor sacs are round both in the male and female. They must not be confounded with the testicles of the male genital organs. Of the two commercial varieties, *Canadian* and *Russian*, the latter contains more castorin. Real sacs, emptied of their natural contents and stuffed with hay, have been met with as adulterations.

PEPSINUM.—Pepsin.—An enzyme obtained from the mucous lining of the fresh and healthy stomach of the pig, sheep, or calf. Tested as described in the following paragraph, it should dissolve 2500 times its weight of hard-boiled white of eggs.

B.P. Characters and Tests.—A light yellowish-brown or white powder, or pale-yellow translucent grains or scales, having a faint odour and a slightly saline taste free from any trace of putrescence, and liable to absorb moisture from the air. Moderately soluble in water, and soluble in about 100 parts of alcohol (90 per cent.). If 12·5 grammes of coagulated and firm white of fresh egg, 125 cubic centimetres of acidulated water containing about 0·2 per cent. of hydrogen chloride (HCl), and 0·005 gramme of pepsin, be digested together at 105° F. (40·5° C.) for six hours, and shaken frequently, the coagulated white of eggs dissolves, leaving only a few small flakes, in an almost clear solution. The 'white of eggs' should be prepared by boiling quite fresh eggs in water for 15 minutes, then immersing them in cold water, and, as soon as sufficiently cool for handling, separating the whites, washing off any fragments of yolk or membrane with water, removing the water with a clean towel, then at once rubbing the whites through a sieve having twelve meshes to a centimetre, and using the product before it has lost moisture. For the 'acidulated water' mix the official hydrochloric acid with water in the proportion of 1 gramme to 156 cubic centimetres; this will give a solution containing about 0·2 per cent. of hydrogen chloride (HCl).

Chemistry.—Pepsin contains a soluble *proteolytic ferment* or *enzyme*, so called on account of its property, in the presence of dilute acids, of converting albumins (insoluble proteins) into soluble peptones. Pepsin is most active in the presence of free acid, its action being entirely inhibited in alkaline liquids. Bismuth salts and compounds of other heavy metals have been shown to be inimical to the proteolytic action of pepsin.

Uses, etc.—In impaired digestion, etc. *Dose.*—5 to 10 grains.

B.P. Preparations.

Glycerinum Pepsini - - - 5 grains in 1 drachm.

The *B.P.C.* includes a large number of simple and compounded preparations of Pepsin.

Preparation of Pepsin.—Pepsin is usually prepared from the mucous lining of the stomach of the pig; the membrane is scraped off, minced up, mixed with dilute hydrochloric acid and subjected to a process of auto-digestion, the resulting liquid contains pepsin, peptones, etc., and for the production of *scale pepsin* is strained, evaporated to a syrup *in vacuo* at a low temperature and dried upon glass plates. *Precipitated pepsin* is produced by precipitating the pepsin from a cold acidulated infusion of the mucous membrane by adding salt in saturated solution.

Pepsinum Saccharatum, consists of pepsin diluted with nine times its weight of lactose.

Peptonum B.P.C.—Peptone, is prepared by the peptic digestion of beef, the peptones produced are obtained by evaporation *in vacuo*. This and the similarly prepared Peptonum Bovinum B.P.C. are used in rectal alimentation (Suppositoria Peptonata and Suppositoria Nutrienta B.P.C.).

Rennet is the name given to the specially prepared fourth or true digesting stomach of the calf; it is used for curdling milk, the enzymes present being *chymosin* and *rennin*. *Liquid rennet, essence of rennet*, etc., are obtained by treating fresh rennet with suitable solvents.

Papain (*Papayotin*) is a powder obtained from the juice of CARICA PAPAYA (the *papaw*) [*N.O.*—Cucurbitaceæ], a tree cultivated throughout the tropics. It contains a digestive (proteolytic) enzyme which acts in neutral or alkaline solution, and is given in cases of impaired digestion (*dose*—2 to 10 grains); it is also used in the removal of warts, etc.

The *B.P.C.* includes Elixir Papaini, Glycerinum Papaini and Liquor Papaini et Iridini.

Ingluvin is an American preparation of, it is said, the gizzard of fowls. To it has been attributed a digestive action similar to that of pepsin, but this statement lacks confirmation.

LIQUOR PANCREATIS.—Pancreatic Solution.—A liquid preparation containing the digestive principles of the fresh pancreas of the pig. The preparation is most active when the animal from which it is obtained has been fed shortly before being killed.

Five ounces (or two hundred and fifty grammes) of the pancreas, freed from fat and external membrane and finely divided by trituration with washed sand or powdered pumice

stone, should be digested, in a closed vessel, in twenty fluid ounces (or one thousand cubic centimetres) of alcohol (20 per cent.) for seven days, and then filtered.

B.P. Test.—If 2 cubic centimetres of the solution, together with 0·2 gramme of *sodium bicarbonate* and 20 cubic centimetres of *water*, be added to 80 cubic centimetres of milk, and the mixture be kept at a temperature of 113° F. (45° C.) for one hour, coagulation should no longer occur on the addition of *nitric acid*.

Chemistry.—The activity of Pancreatic Solution is due to *Pancreatin*, a mixture of the enzymes (ferments) naturally existing in the pancreas of warm-blooded animals; usually obtained from the fresh pancreas of the hog. The action of the pancreas is fourfold, viz.:—(1) Peptonising (proteolytic, due to presence of *trypsin*); (2) milk-curdling (like rennet); (3) diastatic (amylolytic, due to presence of the enzyme *amylopsin*); (4) fat-emulsifying due to the enzyme *steapsin*). These act only in neutral or alkaline solutions.

Note.—The enzymes do not exist as such in the pancreas but as *zymogens*, and the action of *enterokinase*, an enzyme secreted by the duodenum, is necessary to liberate the active enzymes.

PANCREATINUM.—Pancreatin is obtained by preparing an aqueous extract of the pancreas and precipitating the enzymes by means of strong alcohol or evaporating at low temperature until syrupy and then scaling. It is included in the B.P.C., which also has the following preparations: Extractum Malti cum Pancreatin.; Pulvis Pancreaticus Compositus, Glycerinum Pancreatini; from the latter are prepared Emulsio Morrhuæ Pancreaticus, Emulsio Morrhuæ Pancreaticus cum Byno, Cremor Morrhuæ Pancreaticus, and Liquor Pancreaticus.

Uses, etc.—Pancreatin is given as an aid to digestion, especially in conjunction with starchy and proteid foods. It is also used in the preliminary preparation of foods ("peptonised") for invalids and for administration as nutrient enemata.

Note.—Trypsin occuring commercially is not usually the pure enzyme known by that name but a mixture of this and amylopsin. It has been used to a considerable extent both internally, externally, and as a hypodermic injection in cancer, the theory underlying being that cancer is due to deficient production of the pancreatic ferments.

LAC.—Milk.—The fresh milk of the Cow, Bos Taurus, *Linn.*

CLASS—MAMMALIA.

N.O.—Ungulata.

Characters.—A limpid, opaque-white liquid with a sweet taste and faint peculiar odour. S.G. about 1·030. Separating, on standing, into two layers, the upper of which constitutes about one-tenth by volume and is known as cream.

Chemistry.—Milk contains about twelve per cent. of solid matter, the remainder being water. The solid matter consists of *butter fat*, protein (*casein*, etc.), sugar of milk (*lactose*) and various salts. By treatment with acids, preparations of rennet and other ferments, milk is divided into two portions, a liquid *whey* holding the lactose and salts in solution and a more

or less solid portion, the *curds*, which consists essentially of the casein with the fat. The following table gives the average percentage composition of various kinds of milk.

	Water.	Solids.	Fat.	Lactose.	Protein.	Salts.
Woman	87·8	12·2	3·5	6·5	2·0	0·2
Cow	87·2	12·8	4·0	4·5	3·6	0·7
Ass	89·8	10·2	1·2	6·6	1·9	0·5
Ewe	78·2	21·8	9·5	5·0	6·3	1·0
Goat	84·1	15·9	5·8	4·9	4·2	1·0

Milk containing less than three per cent. of fat and eight and a half per cent. of non-fatty solids is liable to suspicion of having had fat removed or water added.

Artificial Human Milk is prepared from cow's milk by reducing the amount of casein present (by dilution with water or other means), and adding milk sugar and cream.

Koumiss is a fermented mare's milk prepared by the natives of Siberia, and introduced also into this country. The fermentation is thought to render the milk more easy of digestion, and to give it medicinal properties.

Bulgarian Sour Milk.—Milk soured by the lactic acid produced by micro-organisms of the group Bacillus acidi lactici has been recommended for use in various intestinal disorders. Cultures of these bacilli in tablet or fluid form are available commercially.

Kephir is a liquid similar to koumiss prepared in the Caucasus.

Condensed Milk is prepared by evaporating milk to which sugar may or may not have been added to a thick syrupy consistence, the evaporation being conducted *in vacuo*. The inferior kinds have the fat removed, and hence when diluted are in no way representative of whole milk.

Dried Milk containing varying proportions of fat is now an article of commerce, it is prepared by rapidly evaporating milk upon the surface of porcelain rollers, the film of dried milk being removed by scrapers.

Casein in many forms and under various names is much advertised as a concentrated nitrogenous, nutritive material for use as an addition to ordinary foods.

FEL BOVINUM PURIFICATUM.—Purified Ox Bile.

—Evaporate one pint (or five hundred cubic centimetres) of fresh ox bile to one quarter of its volume; shake it with half a pint (or two hundred and fifty cubic centimetres) of alcohol (90 per cent.); set the mixture aside until the solid matter has subsided; decant the clear solution, and filter the remainder, washing the filter and contents with a little more alcohol (90 per cent.). Distil off most of the alcohol from the mixed liquids, and evaporate the residue in a porcelain dish, by the heat of a water-bath, until it acquires the consistence of a thick extract.

B.P. Characters and Tests.—A yellowish-green hygroscopic substance, having a taste partly sweet and partly bitter, soluble in water and in alcohol (90 per cent.). A solution in

twenty or thirty times its weight of water, when treated, first with a drop of freshly made syrup consisting of one part of refined sugar and four of water, and then with sulphuric acid cautiously added until the precipitate at first formed is redissolved, gradually acquires a cherry-red colour, which changes in succession to carmine, purple, and violet. Its aqueous solution gives no precipitate on the addition of alcohol (90 per cent.)—absence of unpurified ox bile.

Chemistry.—Ox gall contains "bile-acids" and "bile-pigments." The former are present as sodium salts of *glycocholic* and *taurocholic acids*. The bile-pigments present are *bilirubin*, *biliviridin*, etc. The remainder consists of cholesterol, lecithin, urea, fat and inorganic salts.

Uses, etc.—As tonic and laxative. *Dose.*—5 to 15 grains in pills, etc.

Fel Bovis (*Ox Gall*), U.S.P.—The fresh bile of Bos Taurus. *Characters.*—A brownish-green or dark-green, somewhat viscid liquid, having a peculiar unpleasant odour, a disagreeable, bitter taste, and a neutral or faintly alkaline reaction. S.G. 1·018 to 1·028.

GLANDULÆ THYROIDEA.—Thyroid Gland.—The recently removed thyroid gland of the throat of the sheep, Ovis Aries, freed from enveloping tissues.

CLASS—MAMMALIA.

N.O.—Ungulata.

Characters.—Two-lobed, the lobes oblong or almond-shaped, one to one and a half inches in length, and about three-quarters of an inch broad. Colour, dark-red.

Chemistry.—The principle to which the activity of the gland is due has not yet been clearly identified, it is attributed to the iodine-containing albuminous matter present. The U.S.P. requires dry thyroid substance to correspond to a given test for the presence of iodine.

Uses, etc.—In the treatment of myxœdema, goitre, lupus and other skin affections Given in the form of fresh gland, dried gland (Thyroideum siccum P.B.), glycerin extract, etc.

B.P. Preparations.
Thyroideum Siccum.
Liquor Thyroidei.

Thyroideum Siccum P.B.—Dry Thyroid is a powder prepared from the fresh and healthy thyroid gland of the sheep. Remove the external fat and connective tissue from thyroid glands taken from sheep immediately after killing. Cut the glands across, and reject any which contain cysts, are hypertrophied, or otherwise abnormal. Mince finely the healthy glands, and dry at a temperature of 90° to 100° F. (32·2° to 37·8° C.); powder the dried product; remove all fat

from it by treatment with petroleum spirit; and again dry the residue.

B.P. Characters.—A light dull-brown powder, with a very faint meat-like odour and taste, and free from any flavour of putrescence. It is liable to become damp on exposure to the air, and then deteriorates.

Dose.—5 to 10 grains.

The *B.P.C.* also includes Extractum Thyroidei Liquidum, one part of which represents one part by weight of the gland.

GLANDULÆ SUPRARENALES.—

Supra-renal glands of the Sheep (Ovis aries) or Ox (Bos Taurus). The supra-renal gland is a ductless capsule situated in the fat above the kidney.

Characters.—Ovoid or somewhat reniform in shape, of a grey-brown colour and consisting of a cortex and soft medulla, the active principle is supposed to reside in the latter.

Chemistry.—The physiological properties of the gland are due to the basic principle *adrenine* $C_6H_3(OH)_2CHOHCH_2NHCH_3$, dioxyphenyl-ethanol-methylamine.

Uses, etc.—As hæmostatic, etc., more often employed in the form of the active principle.

B.P.C. Preparations.—Adrenina, Extractum Suprarenalum liquidum, Unguentum Suprarenalis, Suprarenalum Siccum, Pulvis Suprarenalis Compositus, Tablettæ Suprarenales.

Adrenina, the active vaso-constricting principle, also known as *adrenalin, supra-renalin, epinephrin*, etc., is a light buff-coloured powder possessing basic properties, soluble with difficulty in water but readily in dilute hydrochloric acid, the latter solution forming the mode in which the drug is usually employed. Adrenine has been prepared synthetically. Applied by subcutaneous injection or by application to mucous membranes, solutions of adrenine produce local constriction of blood vessels with blanching and arrest hæmorrhage, on this account it is used in tooth extraction and other minor surgical operations.

B.P.C. Preparations.—Liquor Adreninæ Aromaticus, 1 in 1000; Liquor Adreninæ Boricus, 1 in 1000; Liquor Adreninæ Hydrochloricus, 1 in 1000; Suppositoria Adreninæ; Unguentum Adreninæ, 1 in 1000; Unguentum Adreninæ Album, 1 in 1000; Unguentum Adreninæ et Cocainæ; Unguentum Adreninæ Mitis 1 in 5000.

Animal Extracts.—The number of these is on the increase, and preparations of the heart (*cardin*); of the brain and spinal cord (*cerebrin, medullin*); of the testicles (*spermin, orchudin, testiculin*); of the spleen; of the thymus gland; of the pituitary body and others, are met with in medicine.

4. MISCELLANEOUS ANIMAL SUBSTANCES.

OS.—Bone.—The substance forming the skeletons of vertebrated animals.

Chemistry.—Bones consist of an organic portion (*collagen* or *ossein*) which, on prolonged boiling with water, yields gelatin and a large proportion (40 to 60 per cent.) of mineral salts, consisting largely of calcium phosphate with calcium carbonate.

Uses, etc.—For preparing animal charcoal and bone ash (*os ustum*), from which phosphates are prepared. Artificial manures (superphosphate, etc.) are prepared by treating ground bones with sulphuric acid.

OS SEPIÆ.—Cuttle-Fish Bone.—The calcareous growth in the mantle of the common cuttle-fish, Sepia officinalis.

CLASS—MOLLUSCA.

N.O.—Cephalopoda.

Habitat.—Shores of the Mediterranean Sea.

Characters, etc.—The oval or oblong calcareous "bone" is deposited in the mantle of the animal. It has a cellular texture and floats on water. S.G. 0·935. It is from three to ten inches long, and its breadth is about one-third of its length; it is hard upon its upper surface and edges, but soft on its lower side, both surfaces being convex. The layers of the calcium salt are arranged in such a way as to resemble a miniature Giant's Causeway.

Chemistry.—It consists mainly of calcium carbonate (80 to 85 per cent.); proteid matter (four to nine per cent.); water (four per cent.). Its composition is therefore different to that of bone.

Uses, etc.—In making dentifrices, etc.

Note.—Testa præparata.—Oyster shells, either cleaned and powdered or burned, have been used in medicine for purposes similar to those of chalk, they contain about 90 per cent. of calcium carbonate.

SPONGIA.—Sponge.—The soft, elastic skeleton of Spongia officinalis, *Linn.*

CLASS—PORIFERA.

N.O.—Ceratospongia.

Characters.—Masses of ramifying and anastomosing tissue traversed by numerous canals and pores, and during life clothed with a gelatinous envelope, having numerous small mouths on its surface.

Varieties, etc.—The best sponges come from the Mediterranean and Red Seas and are known as Turkey Sponges; inferior kinds from the West Indies. They are collected by divers who remove them from the submarine rocks to which during life they adhere. The gelatinous flesh

is removed by burying the sponges, and as found in commerce, they frequently contain large quantities of sand.

Chemistry.—Sponges consist largely of an albuminoid substance known as *spongin*, which is soluble in hot alkalies and mineral acids. The ash contains iodine and bromine.

Uses, etc.—For bathing, etc.; also for making surgical "tents" and "compresses." Burnt sponge (*spongia usta*) was formerly official in some of the Pharmacopœias: it was obtained by partially burning the sponge and owed its value as a medicine to the presence in it of sodium iodide.

ICHTHYOL.—Ichthyol.

Syn.—Ammonium ichthyol-sulphonate, sulpho-ichthyolate of ammonium.

To obtain ichthyol, a tarry liquid distilled from certain bituminous deposits containing fossil fish (found in the Tyrol) is treated with sulphuric acid and the resulting compound neutralized with ammonia.

Characters.—A reddish-brown viscid liquid of bituminous taste and odour. On incineration it yields no residue; soluble in water and in a mixture of alcohol and ether; treated with potash it evolves ammonia; heated on the water-bath it loses half its weight.

Chemistry.—Volatile Oil, water, *ammonium ichthosulphonate* and ammonium sulphate.

Uses, etc.—Internally and externally in skin diseases. *Dose.*—15 to 30 grains daily in pills. Given externally in the form of ointments, paints, etc.

Note.—Substances similar to the ammonium compound are made with sodium, zinc, lithium, etc. *Thiol* is a similar compound made by treating gas tar with sulphuric acid.

APPENDIX.

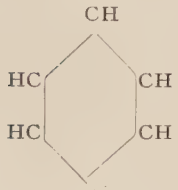
ALKALOIDS.

The word alkaloid is of hybrid derivation and signifies alkali-like. An alkaloid may be defined as a nitrogenous organic compound capable of neutralizing acids. Most vegetable substances containing alkaloids owe their medicinal value to their presence, but an alkaloid is not necessarily the active therapeutic principle of the plant which contains it.

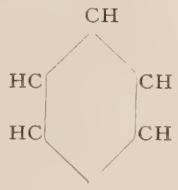
After many researches into the constitution of alkaloids, the theory of Liebig that they were substituted ammonias having the hydrogen atoms replaced by various radicles was partly adopted. This suggestion, founded probably on a consideration of the basic properties of alkaloids and the presence in them of nitrogen, was then worked upon and confirmed first of all by synthetic evidence. Numerous experiments were made by Hofmann with aniline, who proved that this body was capable of having its hydrogen atoms replaced by three successive additions of the ethyl group, resulting in the formation of *phenyl triethylammonium* compound. The latter (an artificial alkaloid) was found to have basic properties, and the nature of the substituted ammonias was thus conclusively proved. It was next discovered that certain alkaloids were derivatives, not of ammonia, but of volatile bases such as pyridine, quinoline, etc., and these latter are now known to be in a sense the nuclei of a number of derivatives, among which are to be found both natural and artificial alkaloids. *Pyridine* is a substance obtained by distilling nitrogenous carbon compounds, and is found in notable quantity in coal tar and in bone oil. The method of arriving at the constitution of such alkaloids may perhaps be best exemplified by a reference to CONIINE, the volatile alkaloid found in hemlock seeds.

By heating coniine, $C_8H_{17}N$, with zinc dust, an evolution of hydrogen takes place with the production as residue of the alkaloid *conyrine*, $C_8H_{11}N$. This on oxidation yields *picolinic* or *pyridine monocarboxylic acid*, C_5H_4NCOOH, showing conyrine to be *propyl pyridine*, $C_5H_4(C_3H_7)N$. Since, therefore, conyrine is obtained from coniine by the removal of six atoms of hydrogen, coniine must be *propyl-hexahydro-pyridine*. By the interaction of iso-propyl iodide with piperidine, *iso-propyl piperidine*, $C_8H_{17}N$

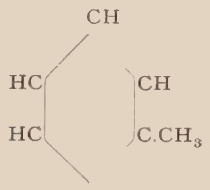
(iso-propyl hexahydro-pyridine) an isomer of coniine, is obtained, but by heating picoline, that is *α-methyl pyridine*, $C_5H_4(CH_3)N$, with acetic aldehyde, *α-allyl-pyridine*, $C_5H_4(C_3H_5)N$, is obtained, and this by addition of eight hydrogen atoms by reduction, yields, *α-propyl piperidine* (*α-propyl hexahydro-pyridine*) or synthetic optically inactive coniine. The stages of this synthesis, and the relation of the alkaloid coniine to the benzene ring may be seen by a glance at the following formulæ :—



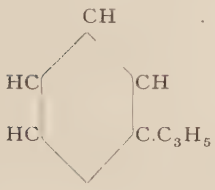
Benzene.



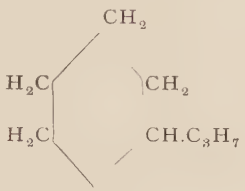
Pyridine.



Picoline.
(Methyl-pyridine.)

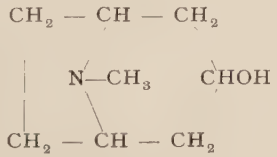


Allyl-pyridine.



CONIINE.
(Propyl-hexahydro-pyridine).

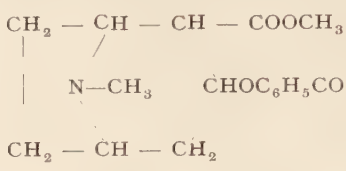
By a similar process, the details of which are both numerous and complex, the constitution of ATROPINE has been arrived at. It was long since known that atropine was capable of being broken up into *tropic acid* and *tropine*, and Ladenburg was the first to produce the alkaloid by the interaction of these two bodies, although his views of the constitution of tropine have since been shown to be incorrect. Tropine is now considered to be a piperidine derivative.



TROPINE.

The constitution of tropic acid has also been worked out, and our knowledge of the atropine molecule thus rendered complete.

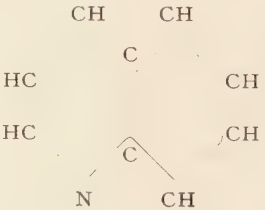
Ecgonine, the basis of the coca alkaloids (cocaine is *methyl-benzoyl-ecgonine*) has also been shown to be a hexahydro-pyridine, a piperidine derivative, and cocaine has the following formula :—



COCAINE.

The Constitution of Morphine has been the subject of numerous investigations during recent years, and it is now recognised as being a *morpholine* derivative of the hydrocarbon, *phenanthrene*.

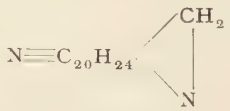
Quinine, since it yields *quinoline* on decomposition, is regarded as a derivative of that body. Quinoline (which is obtained from aniline and other coal tar derivatives) readily forms hydrogen-addition compounds, and *kairine*, a substitution derivative of one of these, has certain quinine-like properties, and has been used as a medicine. The constitution of quinoline is shown as follows :—



QUINOLINE (*Benzo-pyridine*).

while kairine is *hydroxy*-n-*methyltetrahydroquinoline*, $C_{10}H_{13}NO$.

Strychnine is also a quinoline derivative, and is known to contain the nucleus body, *strychnoline*—



which, whilst itself non-toxic, is converted by oxidation into a body having the poisonous and cramp-producing properties of strychnine.

(For further information on the subject of the constitution of alkaloids, the student is recommended to turn to the advanced text-books on organic chemistry, *e.g.*, Pictet, *The Vegetable Alkaloids*, and to the published reports of research work in this direction).

Glossary of Botanical Terms commonly made use of in describing Vegetable Materia Medica.

[In compiling this List large use has been made of the Glossaries contained in the works of M. C. Cooke, Asa Gray and C. C. Babington; indebtedness to all of these is hereby acknowledged.]

A.

Abnormal, departing from the natural order of things.
Abruptly-pinnate, describing a pinnate leaf terminating with a pair of leaflets.
Acaulescent, Acauline, stemless.
Achænium, Achene, small, dry, indehiscent fruit, one-celled and one-seeded.
Achlamydeous, without floral envelopes.
Acicular, needle-shaped.
Acotyledonous, without cotyledons.
Acuminate, pointed.
Acute, sharp pointed.
Adnate, adherent to another portion.
Adpressed, in close contact, but not adherent.
Adventitious, abnormal in order or position of development.
Æstivation, the folding of floral parts in flower-buds.
Agglomerate, heaped up or crowded together.
Agglutinate, glued together.
Aggregate, collected together.
Albumen, a nutritive substance found in seeds surrounding the embryo and external to the cotyledons.
Albuminous, furnished with albumen.
Alburnum, sap-wood of a dicotyledonous tree.
Alliaceous, pertaining to the *allium* or garlic family: smelling like garlic.
Alternately-pinnate, having the leaflets of a pinnate leaf alternately inserted on the petiole.
Amentum, a scaly spike or catkin.
Amphitropous, applied to an embryo with hilum between micropyle and chalaza.
Amplexicaul, embracing the stem.
Amylaceous, starchy.
Anastomosis, inter-connection of cross veins or vessels by means of branches.
Anatropous, of an ovule, with the micropyle close to the hilum, the chalaza being at the opposite end.
Andrœcium, the male organs of a flower.
Angiocarpous, having the fruit covered by an envelope.
Angiospermous, with the ovule enclosed in an ovary.
Angular, with projecting angles (describing leaves and stems).
Annual, lasting one year.

Annular, having the form of a ring.
Annulate, marked with rings.
Anther, the pollen-bearing part of a stamen.
Apetalous, without petals.
Apex, the opposite extremity to the point of attachment.
Apothecia, fructification of fungi and lichens bearing spores.
Appendage, a part superadded or subsidiary.
Aril, an extension of the placenta encompassing the seed, as the mace of the nutmeg.
Arillate, possessing an aril.
Arillode, a false aril originating from the micropylar region of the seed.
Articulated, jointed, separating freely.
Asci, spore-cases; imbedded sacs containing spores (ascospores).
Auriculate, having a pair of lobes or ear-shaped appendages.
Awn, a bristle-shaped appendage, *e.g.*, beard of barley.
Axil, the angle between the stem and leaf.
Axillary, growing in the axils.

B.

Bacca, an indehiscent pulpy fruit resulting from an inferior ovary.
Balausta, the fruit of the pomegranate.
Bark, non-living cortical tissue, cut off by a layer of phellogen (*see* also *Barks*).
Bi-cornute, with two horn-like processes.
Biennial, vegetative growth one year, flowering and fruiting in the succeeding.
Bi-furcate, doubly forked.
Bracts, leaves (generally modified in form) growing in connection with the flowers.
Bulb, modified shoot, with fleshy scale-leaves; generally upon, or partly beneath the soil.
Bulb, tunicated, a bulb with thin membraneous scales, forming concentric coats.

C.

Caducous, dropping off very early.
Calcarate, spurred.
Calceolate, having the form of a slipper.
Calyx, the external whorl of the floral envelope.
Cambium, meristematic tissue, primary or secondary occurring in all parts external to the xylem in Dicotyledons.
Campanulate, bell-shaped.
Campylotropous, describing an ovule so bent that the micropyle is brought near the hilum, the chalaza also being near the hilum.
Capitulum, the inflorescence of flowers of the *N.O.* Compositæ.
Capsule, a dry, dehiscent multi-carpellary seed-vessel or fruit.
Caryopsis, a dry one-seeded indehiscent fruit, with adherent pericarp.
Carpel, one of the modified leaves composing or being a pistil.
Catkin Amentum, a scaly spike of unisexual flowers.
Cauline, belonging to the stem.
Cellular, composed of cells.
Cellulose, the material of which unmodified cell-walls consist.
Chalaza, in a seed, the point of origin of the integuments.
Channelled, hollowed out like a gutter.
Circumscription, the outline of a leaf or other organ.
Coccus, one of the parts into which a tricoccous capsule splits up.
Convolute, rolled up longitudinally.
Cordate, heart-shaped—applied to leaves.
Cordate-hastate
Cordate-saggitate } Cordate but modified by the other characters.
Cordate-ovate

Coriaceous, of a leathery texture.
Corm, a swollen, succulent stem or base of a stem.
Corneus, horny in texture.
Corolla, the inner whorl of a floral envelope.
Cortex, strictly extra-stelar tissue between the stele and the epidermis, usually in Materia Medica—the bark.
Corymb, a centripetal or racemose inflorescence in which the pedicels originate at different heights on the axis, but elevate all the flowers to nearly the same level.
Corymbose, resembling a corymb.
Cotyledons, seed-leaves of an embryo.
Cremocarp, a fruit of two one-seeded carpels (mericarps), which, when ripe, separate and are suspended from a carpophore, as in Umbellifers.
Crenate, with convex teeth—applied to the margin of leaves.
Crenulate, diminutive of *crenate.*
Cryptogamia, plants having no evident or true flowers.
Culm, the straw or stem of grasses.
Cuneate, wedge-shaped.
Cyme, an inflorescence developed in a centrifugal or sympodial manner.
Cypsela, a one-seeded indehiscent, inferior fruit, resulting from a unilocular ovary, generally surmounted by the remains of the calyx as a pappus.

D.

Deciduous, applied to plants the leaves of which are shed annually.
Decompound, having compound divisions.
Decorticate, deprived of the bark or cortical layer.
Dehiscence, splitting into regular parts.
Dentate, toothed.
Denticulate (diminutive), having small teeth.
Dichotomous, forked or furcate in pairs.
Dicoccous, splitting into two cocci.
Dicotyledonous, having two cotyledons.
Digitate, having several leaflets radiating from the apex of the leaf-stalk.
Digitate-pinnate, describing a digitate leaf with pinnate leaflets.
Diœcious, having unisexual staminiferous flowers borne on one plant, pistilliferous on another.
Dissepiment, partition of, *e.g.*, a fruit.
Drupe, succulent or fleshy fruit, with a hard-shelled seed or stone.
Drupel, a little drupe.
Duramen, heartwood of dicotyledonous trees.

E.

Emarginate, having a notch at the extremity.
Embryo, rudimentary plant within the seed.
Endocarp, inner layer of a pericarp.
Endogenous, having origin in deep-seated tissues.
Endophlœum, inner layer of bark. The liber.
Endopleura, the innermost skin of a seed-coat.
Entire, having no marginal divisions or serratures.
Epicarp, the outer layer of a pericarp.
Epidermis, outermost cell layer of plants.
Epigynous, growing or appearing to grow upon the ovary.
Epipetalous, growing upon the petals.
Epiphlœum, the outer layer of bark.
Epiphytic, growing upon another plant, from which it derives food-substance.
Etærio, a fruit composed of agglomerated drupes.
Exalbuminous, without albumen, describing seed in which the albumen is contained in the embryo.
Exogenous, having origin in superficial tissues.

F.

Falcate, sickle-shaped.
Farinaceous, with the nature of flour.
Fascicled, Fasciculated, in bundles proceeding from a common point.
Fastigiate, nearly parallel, pointing upwards.
Feather-veined, where the primary veins are nearly straight, parallel, and run to the margin.
Ferruginous, rust-coloured.
Fibro-vascular, consisting of woody vessels and fibres.
Florets, the small flowers comprising the capitulum of composite plants.
Foliaceous, having the form or texture of a leaf.
Follicle, a fruit of one carpel, dehiscing by the ventral suture.
Foramen, the aperture in the integuments of an ovule.
Fornicate, arched.
Frond, combination of leaf and stem; the leaf-like expansion of Ferns, Algæ, etc.
Fruticose, shrub-like.
Fugacious, falling off rapidly.
Funiculus, vascular thread connecting the ovule or seed with placenta.
Fusiform, spindle-shaped.

G.

Galbulus, a modification of the strobilus with enlarged or fleshy scales.
Gall, a pathological growth produced by the puncture of an insect.
Gamopetalous, with the petals united.
Gamosepalous, with the sepals united.
Germination, the first development of an embryo.
Gibbous, having pouches or convex swellings.
Glabrous, destitute of hairs, smooth.
Glans, an indehiscent fruit seated in a cupule.
Glaucous, Glaucescent, covered with a bloom of a bluish-green tinge.
Glume, the chaff-like scale of the flower of grasses.
Gymnosperms, plants having naked seeds.
Gynandrous, having stamens and pistil united into one body.
Gynœcium, the pistil and its appendages.
Gynophore, a pedicellary support to the ovary.

H.

Habitat, the situation of a plant in its wild state.
Hastate, halbert-shaped, applied to leaves,
Hermaphrodite, of both sexes, having both stamens and pistil.
Hesperidium, a fruit of the orange kind.
Hilum, scar left by the separation of seed from its placenta.
Hispid, covered with long stiff hairs.
Histology, that branch of biology which treats of animal and vegetable tissues.
Hypogynous, growing from beneath the ovary.

I.

Imbricate, overlapped, like the tiles of a house.
Imparipinnate, describing a pinnate leaf terminated by a single leaflet.
Incomplete, destitute of some organ normally present.
Incumbent, applied to an embryo when its radicle is folded upon the back of the cotyledons.
Indehiscent, not splitting when ripe (applied to fruits).
Indusium, the involucre or covering of the sporangia of ferns.
Inferior, growing below, as when one organ is below another.
Inflorescence, the mode of disposition of flowers upon the stem.
Intercellular, between cells.
Internode, the space between two nodes.
Intorse, turned towards the axis.
Involute, with the edges rolled inwards.

Irregular, flowers are said to be irregular when there is a lack of symmetry in their parts.

L.

Labiate, lipped, describing a monopetalous corolla, with two unequal divisions.
Labium, the lower lip of a labiate flower.
Lactiferous, latex-bearing.
Lamina, the blade of a leaf.
Lanceolate, having the form of a lance-head ; elliptical, tapering to both ends.
Latex, the viscid fluid contained in laticiferous vessels.
Laticiferous Vessels, anastomosing tubes, containing the latex.
Legume, a unilocular capsular fruit dehiscing from both sutures.
Lenticels, small lens-shaped spots on young bark.
Liber, the inner layer of the bark.
Ligula, one of the strap-shaped florets of the ray of Composites.
Limb, the upper expanded portion of a petal.
Linear, with parallel sides.
Lobe, a rounded portion of a leaf or petal.
Loculicidal, dehiscing through the dorsal sutures of the carpels.
Lyrate, pinnatifid, with the upper lobes largest.

M.

Medulla, the pith or central column of dicotyledons.
Medullary Rays, cellular plates passing from the pith to the cortex in dicotyledonous stems.
Mericarp, one of the carpels of the fruit of an umbellifer.
Mesocarp, the middle or intermediate layer of a pericarp.
Mesophlœum, the middle layer of the bark, between the liber and epiphlœum.
Mesophyllum, all the cellular portion of a leaf lying between the upper and lower epidermis.
Micropyle, the aperture in the integuments of the ovule leading to the nucellus.
Moniliform, necklace-shaped ; constricted at intervals.
Monochlamydeous, with only one floral envelope.
Monocotyledonous, having but one cotyledon.
Monœcious, with male and female flowers on the same plants.
Monopetalous. *See* Gamopetalous.
Morphology, the study of the forms of organs.
Mucous, slimy, or covered with a slimy secretion.
Mucronate, abruptly pointed by a sharp spine or mucro.
Muricate, Muriculate, rough, with hard excrescences.
Mycelium, the vegetative filaments of fungi.

N.

Node, that portion of a stem at which a leaf arises.
Nodose, Nodulose, knotted, with swollen joints.
Nucellus, the internal tissue of the ovule containing the embryo sac.
Nuculanium, a superior pulpy stony-seeded fruit, *e.g.*, grape.

O.

Obcordate, invertedly cordate.
Obovate, invertedly ovate.
Obtuse, blunt or rounded.
Obvolute, having the margins of one organ alternately overlapping its vis à vis.
Offset, a short lateral shoot or runner, ending in a bud.
Oppositely-pinnate, pinnate with the leaflets arranged in pairs.
Orbicular, circular.
Ovary, the lower portion of the pistil containing the ovules.

Ovate, elliptical, broader at the base, shaped like an egg.
Ovule, that part of the flower which, when fertilized, becomes the seed.

P.

Palmate, lobed, with midribs diverging from a common centre (multicostate venation).
Palmatifid, having the margin divided in a palmate manner.
Palmatipartite, having the lamina deeply divided in a palmate manner.
Palmatisect, having the lamina divided almost to the midrib in a palmate manner.
Palmi-nerved, said of the veins of a leaf arranged in a palmate manner.
Panicle, a branched raceme or corymb.
Papilionaceous, with a corolla like a butterfly.
Pappus, the coronate calyx of Composites.
Papyraceous, paper-like in texture.
Parallel-veined, having the veins running parallel along the leaf, or from the midrib to the margin.
Parenchyma, cellular tissue, composed of regular cells.
Parietal, borne on or growing to walls.
Paripinnate, equally pinnate.
Pedate, where the parts have a palmate arrangement, the lateral portions being once again subdivided.
Peltate, shield-like, attached by centre of surface.
Pendulous, hanging down.
Pepo, a succulent, inferior, one-celled fruit, with seeds borne on three parietal placentas; a gourd fruit.
Perennial, lasting some years and flowering annually.
Perfoliate, having the petiole apparently traversing the centre of the leaf.
Perianth, the complete floral envelope consisting of the calyx or corolla or both.
Pericarp, the covering shell or rind of fruits.
Perigynous, growing upon the calyx or upon some part which surrounds the ovary.
Perisperm. Nucellar tissue persisting in the ovule after fertilisation.
Persistent, not falling away.
Personate, masked; describing a gamopetalous corolla, resembling the mouth of an animal.
Petals, the parts of the corolla.
Petiole, the leaf-stalk.
Phanerogamous, having conspicuous or evident flowers.
Pinnæ, the leaflets of a pinnate leaf.
Pinnate, divided in a feathery manner.
Pinnatifid, divided halfway to the midrib in segments in a pinnate-manner.
Pinnatipartite, having the lamina deeply divided in a pinnate manner.
Pinnatisect, divided nearly to the midrib in a pinnate manner.
Pistil, the female organ of flowering plants, consisting of ovary and stigma (with or without style).
Placenta, the infolded, and in some cases otherwise modified, edge of a carpellary leaf bearing the ovules.
Placentation, the manner in which the placentas are developed.
Plicate, plaited in folds like a fan; applied to vernation.
Plumule, the rudimentary bud of an embryo.
Pollen, the fertilizing matter of anthers; the ultimate male elements of the plant.
Polyandrous, said of a flower having an indefinite number of stamens.
Polycarpous, with many distinct carpels or fruits to each flower.
Polyembryony, increase in the number of embryo sacs in the nucellus.
Polypetalous, having the petals free or distinct.
Pome, a many-celled succulent inferior fruit (apple)

Premorse, having an irregular termination as if bitten off.
Primine, the outer integument of an ovule.
Prosenchyma, tissue composed of elongated pointed cells, forming what is termed fibre.
Pubescent, downy.
Putamen, the hard bony stone (endocarp) of certain fruits, as the peach.
Pyriform, pear-shaped.
Pyxidium, a capsule opening with a lid.

R.

Raceme, an indeterminate, centripetally or monopodially developed inflorescence.
Racemose, resembling a raceme.
Radicle, the first or primary root of a plant.
Raphe, the adherent vascular thread connecting the hilum of an ovule with the chalaza.
Receptacle, a support to one or more similar organs; a chamber in which secretions are stored.
Regular, having all the parts of the organ symmetrical in shape and arrangement.
Reniform, kidney-shaped.
Reticulate, having the appearance of network.
Revolute, rolled backwards.
Rhizome, Rootstock, a prostrate or subterranean stem, bearing leaves (usually scale) and axillary buds on its upper surface and roots along the under surface.
Rotate, applied to a gamopetalous corolla, with a short tube and spreading limb.
Rudimentary, in an incomplete condition.
Runcinate, toothed like a pit-saw, with the tooth inclining backwards.
Runner, a slender prostrate stem, rooting at the nodes.

S.

Saggitate, shaped like an arrow-head.
Samara, a winged, indehiscent fruit.
Sarcocarp, a fleshy mesocarp, the succulent layer of a drupe.
Scabrous, Scabrid, rough.
Scales, rudimentary or metamorphosed leaves.
Scape, a long naked radical peduncle rising from the ground.
Scarious, with a thin, dry, shrivelled appearance.
Scutate, buckler-shaped.
Scutiform, shaped like a shield or dish.
Secundine, the inner coat of an ovule.
Sepals, the divisions of the calyx.
Septate, having partitions or divisions.
Septicidal, describing a fruit dehiscing along the sutures of the carpels, dividing the dissepiments.
Septifragal, describing a fruit splitting by the separating of the backs of the carpels from the septa.
Septum, a partition in an ovary or fruit.
Serrate, toothed in a saw-like manner.
Sessile, without a stalk.
Sheath, a petiole of a leaf wrapped round a stem forming a case.
Silicule, a siliqua about as broad as long.
Siliqua, a long pod with two placentas and a false dissepiment (replum).
Sinuate, with a waved or lobed margin.
Soboles, a creeping underground stem.
Sori, clusters of spore-cases in ferns.
Sorosis, a compound fleshy fruit, resulting from many flowers.
Spadix, a fleshy spike, with many sessile flowers, usually enclosed within a spathe.

Spathe, a large bract sheathing an inflorescence.
Spathulate, spoon-shaped.
Spike, an inflorescence of sessile flowers on a rachis.
Spores, Sporules, the reproductive bodies of Cryptogams.
Squarrose, rough, with projecting appendages.
Stamen, the male organ of flowers, normally consisting of anther and filament.
Stigma, that portion of the style to which the discharged pollen adheres.
Stipules, leaf-like processes developed at the base of the petiole.
Stole, Stolon, a lax trailing and rooting branch.
Stomata, respiratory apertures in the epidermis.
Strobilus, an imbricated scaly inflorescence; a cone.
Style, the prolongation of the ovary bearing the stigma.
Stylopodium, a fleshy disk, bearing the styles in Umbellifers.
Suberous, corky.
Subulate, awl-shaped.
Superior, describing an organ placed above and free of another.
Syconus, a hollow bag-like compound fruit, as of the fig.
Syncarpous, describing a fruit with adherent carpels.

T.

Tap-root, a simple conical root with branches proceeding from it.
Terete, cylindrical.
Ternate, arranged by threes.
Testa, the outer skin of a seed.
Tetradynamous, when, of six stamens, two are longer than the others.
Thalamifloral, Thalamiflorous, having the petals and stamens inserted on the thalamus or receptacle,
Thalamus, the receptacle or disk of a flower, as in the Compositæ.
Thallophytes, cellular plants, the plant-body being a thallus.
Trachea, a spiral vessel.
Tricoccous, said of a fruit consisting of three elastically dehiscing cocci.
Trifoliate, having three leaflets.
Tripinnate, when the pinnæ of a bipinnate leaf are again pinnate.
Truncate, terminating very abruptly.
Tuber, a swollen succulent internode of an underground stem.
Tubercled, covered with warts.
Tubercule, succulent knob-like expansions of certain roots.

U.

Umbel, an inflorescence in which the pedicels all proceed from the top of the peduncle reaching to about the same height.

V.

Valvate, united by the edges only.
Venation, the arrangement of veins in a leaf.
Vernation, the arrangement of leaves in the bud.
Verticel, a whorl or circle of bodies around a stem.
Verticillate, in whorls or verticels.
Vesicle, a bladder-like cavity.
Vittæ, narrow oil-containing ducts or canals found in the fruits of Umbellifers.

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